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U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
A. C. TRUE, DIRECTOR.

ANNUAL REPORT OF THE ALASKA AGRICULTURAL EXPERIMENT STATIONS, 1904.

BY

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Special Agent in Charge.

[Reprint from Annual Report of the Office of Experiment Stations for the year ended June 30, 1904.]

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ANNUAL REPORT OF THE ALASKA AGRICULTURAL EXPERIMENT STATIONS, 1904.

By C. C. Georgeson, *Special Agent in Charge.*

WEATHER CONDITIONS.

For the first time since these investigations began it becomes necessary to report the failure of many crops under experimentation. The season has been the coldest on record in the coast region. In the interior the season was cold and backward, but some of the early grain matured and some of the vegetables grew better than on the coast. South of the coast range, along the entire stretch from Portland Canal to Unalaska, grain has been a complete failure, the summer not being warm enough to mature it. Vegetables of even the hardier sorts have been a success only when the garden happened to be located in sheltered places. Potatoes have yielded but one-fourth of a crop in weight, and often half of these are too small for use. Cabbages have failed to head, and even turnips, ruta-bagas, and carrots have done poorly. The weather reports submitted herewith tell the story of low temperatures, continual rain, and lack of sunshine. Cloudy, rainy weather has also prevailed in the interior to a much greater extent than is normal for that region. Nevertheless, there was enough sunshine to mature quick-growing early crops. At the Copper Center Station nearly all of the Sixty-day oats, a variety imported from Russia by the U. S. Department of Agriculture, matured; and at Rampart Station, in latitude 65° 30′ N., 3½° north of Copper Center, all varieties of barley and oats matured; and it is to be noted that grain has matured at Rampart every year since we began work there. The explanation is to be found in the fact that there is more sunshine during the summer months in that latitude than in the region farther south.

It should be noted that the winter of 1903–4 was unusually severe, particularly in the coast region; not, indeed, in excessively low temperatures, but in moderately low temperatures long continued, accompanied with high winds. The snowfall was light, and vegetation not in sheltered places suffered from the cold, drying winds. Salmon berries, blackberries, and cranberries among the native vegetation were killed in exposed places. This year there are none of these

berries in Alaska except in sheltered spots. Fifty per cent of the native elderberry bushes on Castle Hill, Sitka, were killed by the cold. These facts will account for the killing back of the young wood on much of our nursery stock, and, followed by a cold summer with little sunshine, tree growth is naturally backward.

BRIEF SUMMARY OF WORK.

Since the last report the following has been accomplished at the several stations:

CLEARING LAND.

Twenty-one acres have been cleared at the Copper Center Station. This, with the 16 acres under culture the past season, will make 37 acres available for culture at that station. Only 6 acres of the newly cleared land has been broken, but it is hoped to break most of the remainder in the spring in time for seeding.

At Kenai Station 3½ acres have been cleared, fenced, and broken, making 24½ acres under culture at that place. At Rampart Station 2½ acres have been cleared and broken and will be fenced, giving us 3 acres at that station, and at Sitka 1 acre has been cleared and fenced and partly drained, which increases the amount cleared to 6½ acres.

BUILDINGS AND IMPROVEMENTS.

At the Copper Center Station a log house 16 by 24 feet, with a shed attached, has been completed and is now occupied by the superintendent of the station. A log barn 20 by 24 feet with large sheds has been so far completed as to be in use, and a cache and seed room raised from the ground has been built.

At Rampart Station an addition 12 by 16 feet has been added to an old log cabin so as to make the place habitable for the superintendent.

At Sitka Station a house has been built over the large rain-water tank, and a propagating house 10 by 20 feet, with attached workroom 10 by 15 feet, is under construction, though not quite completed at this writing. A large manure shed has been built as an addition to the barn. Another improvement has been accomplished by putting the city water into the main building.

EQUIPMENT AND SUPPLIES.

A complete equipment of tools, implements, and machinery has been purchased for the Rampart Station and safely delivered at its destination. Nursery stock has been purchased for the growing nursery at the Sitka Station, and seed grain and fertilizers have been purchased for all the stations.

EXPERIMENTS.

Detailed accounts of the experiments at each station are submitted herewith. At the Copper Center Station the main aim has been grain growing. To this end all the hardy, early maturing varieties of small grain that we have been able to produce have been grown. Experiments to ascertain the effect of fish guano as a fertilizer on the growth of these grains have been under way. Some grasses and forage plants have been grown, and also a small amount of the common hardy vegetables.

The experiments at the Kenai Station may be said to be in a transition stage from that of grain growing to dairy work. The summers are too cool at Kenai for grain growing, but stock feed can be grown in any quantity. We have four milch cows now at the station, and it is hoped that we can increase this number to a dozen or more and to supply the station with the necessary utensils to run a small dairy. Mr. Ross has made a little butter, which he reports to be of fine quality. The farm was seeded to grain under various forms of fertilizer experiments, but since the grain failed to mature and had to be cut for hay no conclusions can be drawn, except the broad general statement that fertilizers stimulate the growth in a large degree.

The Rampart Station has been and will be devoted wholly to the problems involved in grain growing, with such horticultural efforts as it may be practicable to undertake.

The experiments at the Sitka Station have in the main consisted in testing the growth of varieties of fruits which give promise of some degree of success. To this end nursery stock of many varieties and from several sources has been procured. The tests are confined to early maturing sorts, the stock selected being from nurseries in the coldest regions in the United States. An attempt is being made to propagate raspberries and currants for distribution, which have done well here. Several thousand apple seedlings, grown from selected hardy varieties, have been procured from the Minnesota Experiment Station. These will be used partly for propagation and partly to send out over the Territory before propagation to test their hardiness.

Fertilizer experiments proved that the soil needs lime, though they were inconclusive in other respects owing to the crops failing.

GRASS INVESTIGATIONS.

In compliance with the suggestion made in my last report that specialists in the Department could cooperate with us in scientific investigations, Prof. C. V. Piper, of the office of the Agrostologist, Bureau of Plant Industry, made a trip of two months' duration along

the coast region from Sitka to Unalaska for the purpose of investigating which species of grasses and forage plants are of practical value in that region, to determine the value of the grazing lands, and to make collections of the flora. Professor Piper's report is submitted herewith. It covers very satisfactorily the ground he has gone over. But there are still extensive regions in the Territory in which no investigations of that character have been made. Numerous inquiries reach this station about the grazing conditions in the Aleutian Islands. There is but little definite knowledge on the subject, and no one connected with the station can spare the time to spend a summer among these islands. It will take a full season's work, considering the lack of transportation facilities along the islands, and the work can not be done except by special provision for the use of a boat. If arrangements could be made with the Navy Department to secure one of the navy launches, used in connection with the building of the coaling station on Kiska Island, it would be very desirable. There are also stretches of pasture lands in the interior, which it will take two seasons to investigate fully. I therefore recommend that this work be continued and suggest that it can not be placed in better hands than those of Professor Piper.

ENTOMOLOGICAL WORK NEEDED.

No entomological investigations have been made in Alaska. The station receives frequent complaints of injurious insects attacking garden vegetables, and as there is no entomologist connected with the station it would be very desirable if arrangements could be made with the Department by which an expert from the Bureau of Entomology could be detailed to spend a season in Alaska.

INTRODUCTION OF CATTLE.

Professor Piper refers with some detail to the efforts that are being made at stock raising as a commercial enterprise, and it is not necessary to dwell on it further than to renew the recommendation made in former reports that an appropriation be made for the introduction of breeds suitable to the climatic conditions prevailing in the Territory. The cattle which are now here are not well adapted either to the wet weather of the coast or the cold weather of the interior. The writer believes that the Government would confer a lasting benefit on the Territory by introducing the Galloway breed of cattle and such hardy sheep as the Black-faced Scotch. For dairy purposes a strain of milking Shorthorns will be better adapted to the country than the Jerseys or Jersey grades, which are at present most common.

TEACHING GARDENING TO THE INDIANS.

The writer ventures to renew his recommendation that steps should be taken to teach vegetable growing to the natives of Alaska. They are slowly acquiring a taste for vegetables, and their demands for seed are yearly more numerous. They know nothing about the culture of plants aside from potatoes and turnips. Instead of feeding them with rations it will be cheaper to send an instructor in gardening to visit the principal villages, supply them with seed, give practical instruction in their culture, and perhaps maintain model gardens for a few years. It will cost less than to supply them with food, and the Indians will be better off in the end.

REPORT OF C. V. PIPER ON THE GRAZING LANDS OF THE SOUTH ALASKA COAST AND THEIR POSSIBLE UTILIZATION.

The following is a report of investigations made during the summer of 1904, in which the Alaska Experiment Station, through the Office of Experiment Stations, cooperated with the Bureau of Plant Industry, represented by the office of the Agrostologist.

ITINERARY.

Acting under instructions from the Agrostologist, I arrived at Sitka July 14, where three days were spent in consultation with Professor Georgeson regarding the scope of the proposed investigations and in acquiring such available data as would aid in the work. July 15 an excursion to the head of Skwashianski Bay made possible an examination of the small area of meadow lands there, which are said to be fairly typical of similar lands in southeastern Alaska. Leaving Sitka July 16, I arrived in Kadiak July 24, touching en route at Yakutat, Kayak, Orca, Ellamar, Valdez, Seward, Seldovia, Homer, Aurora, and Innerskin Bay, at most of which places opportunity was offered for a brief examination of the shore.

Six days were spent on Kadiak Island, mostly in the vicinity of Womens Bay, where a Seattle company has entered extensively into the raising of sheep and cattle.

Proceeding westward July 30, Unalaska was reached August 4. On this route, both going and returning, brief stops, varying from one to twelve hours, were made at Uyak, Karluk, Cold Bay, Chignik, Unga, Sandpoint, Bellkofski, Unimak Pass, and Dutch Harbor. Though these stops were brief, they enabled me at most places to make a survey of the neighboring lands.

August 10 I was again in Kadiak, and on the following day reached Seldovia, on Cook Inlet.

In order to examine the Kenai peninsula, and especially Kachemak Bay, the site of the proposed Finnish colony, it was necessary to travel by sloop, a slow but fairly satisfactory mode of progress. Eight days were thus spent, visiting Homer, Aurora, Port Axel, the Finnish colony site, Anchor Point, Ninilchuck, Kussilof, and Kenai.

Leaving Seldovia August 23, Yakutat was reached on August 29, touching en route most of the places visited while going west. Five days were spent near Yakutat examining the surrounding region, and especially the flat meadow lands lying along the Ankou and Setuck rivers. September 4 Sitka was again reached.

INTRODUCTION.

The south Alaska coast from Portland Canal, its extreme southeastern inlet, in longitude 130° W., to Unalaska, in longitude 166° W., forms almost a semicircle, its diameter being the fifty-fourth parallel, and its most northern points, Valdez and Tyonook, lying just north of the sixty-first parallel. The total length of this stretch of coast, ignoring bays and inlets, is about 2,000 miles.

Officially, the region from Mount St. Elias, longitude 141° W., southeastward is designated southeastern Alaska. Westward of Mount St. Elias the coast region forms southwestern Alaska.

From a biological standpoint, Cook Inlet forms a much more natural point of division. Eastward from this inlet the land is for the most part densely covered with timber, while to the westward the lands are mainly grass covered and devoid of timber.

Of the islands to the westward of Unalaska little is known from the standpoint of agriculture, no examination with this end in view ever having been made.

The total area of the grass lands of the south Alaska coast approximates 10,000 square miles. Nearly all of this lies between Cook Inlet and Unalaska. Of this total area at least one-half would seem to be capable of utilization. Much of this last is covered with tall and rank grasses, often 6 feet high. The remainder, lying in more exposed situations or at higher elevation, produces grasses that are too short for hay cutting, but furnish splendid pasturage.

GRAZING LANDS OF SOUTHEASTERN ALASKA.

THE YAKUTAT PLAINS.

The only extensive areas of grass lands known in southeastern Alaska are those lying in the river valleys near the coast south of Yakutat. Inasmuch as these lands have been several times referred to in reports, and as they are now in part accessible owing to the building of the Yakutat and Southern Railway, a careful examination was made of them. This railway has been built primarily to tap the several rich salmon streams flowing into the ocean south of

Yakutat, it being impracticable to fish them by approach from the ocean. The railway, which is projected to be built to the Alsek River, a distance of 45 miles, at present is built only to the Setuck River, 10 miles from Yakutat.

Practically the whole of this region is an old glacial moraine composed of fine gravel, which slopes very gently to the seashore. The land close to the seashore is somewhat higher than that lying behind and is heavily timbered. Owing to this strip of higher land, most of the streams flow parallel with the coast for some distance near their debouchments. It is along the valleys of these streams that the grass lands lie, but owing to the flatness of the land and the slight elevation above the sea level they are very poorly drained, notwithstanding the gravelly nature of the soil.

Traveling along these rivers in a canoe one receives the impression that the grass is tall and rank on these flat lands. This, in fact, is the case on a very narrow strip just along the river banks, where there is fine growth of bluetop (*Calamagrostis langsdorfii*) and sedge (*Carex cryptocarpa*). This strip of tall grass is, however, nearly always confined to the immediate banks of the rivers. The great mass of the land is covered with a thin layer of bog moss, which supports but a scant vegetation of grass and sedges less than a foot high.

It is a conservative statement to say that fully 80 per cent of these Yakutat grass lands are thus scantily grassed. Apart from this meager amount of grass, which practically precludes the cutting of winter forage, another serious difficulty presents itself in the fact that poison parsnip (*Cicuta douglasii*) occurs quite plentifully over all the land that is the least boggy, which, as before stated, is 80 per cent of the area. Thus, even if these meadows were used for grazing, great care would need to be exercised in the spring, when grass is scanty and the sweet but very poisonous tubers of this plant are frequently forced to the surface by the frost.

While the above statements are true concerning the Yakutat meadows as a whole, there are small areas which are exceptional. For example, along the lower Ankou occurs a narrow strip of several hundred acres well grassed with silvertop (*Deschampsia cæspitosa*) and beach rye (*Elymus mollis*) and free from Cicuta. Care would need to be exercised in utilizing even this, as the surrounding boggy lands bear an abundance of poison parsnip.

Again, the strip of land lying just within the ocean dunes is often well grassed with beach rye and red fescue (*Festuca rubra*).

A particularly good area of arable land lies along the railway where it reaches the Setuck River. This consists of 3 or 4 square miles of gravelly, well-drained, level land, at present looking much like a run-out meadow. It is apparently very well adapted to such cultivated grasses as smooth brome and tall meadow oat grass. It

will undoubtedly grow all sorts of hardy vegetables. The present grass covering is rather scanty, but it is probable that this can be greatly increased by cultivation. This particular piece of land is well worthy of homesteaders' attention.

It is within the bounds of possibility that the larger part of the Yakutat plain can be drained and made into fine meadow lands. In their present state, however, they are not adapted to stock raising, with the exception of such small areas as above noted.

OTHER GRASS LANDS IN SOUTHEASTERN ALASKA.

Apart from the Yakutat plains there are no extensive grass areas known in southeastern Alaska. Along many of the quiet inlets and channels are narrow strips of grass on the higher beaches composed largely of beach rye, but the acreage of these is always small. At the heads of some of the inlets more extensive areas of a similar character occur, some of which may contain 100 acres or more. The lower portions of such flats are covered with sedges and beach rye, while in the higher portions bluetop (*Calamagrostis langsdorfii*) is the principal grass.

Where such lands lie near enough to the towns they furnish admirable sites for small dairy or stock farms, and undoubtedly many of them will be so utilized.

GRAZING LANDS OF SOUTHWESTERN ALASKA.

THE KENAI PENINSULA.

That portion of the Kenai Peninsula lying on Cook Inlet and north of Kachemak Bay, comprising an area 100 miles long by 20 to 30 miles wide, is an extensive plateau. Its southern portion, on Kachemak Bay, lies 500 to 1,000 feet or more above the sea level. It slopes mainly to the westward, so that the portion from Anchor Point northward is but 100 to 200 feet above the sea level. Most of this land is timbered, but there are considerable areas of grass lands near Anchor Point, near Homer, and at the site of the proposed Finnish colony.

At Homer there is an extensive sand spit about 4 miles in length and from one-quarter to 1 mile across. This spit supports a good growth of several grasses and sedges. Beach rye (*Elymus mollis*) is the most important and most abundant, but red fescue (*Festuca rubra*), bluegrass (*Poa pratensis*), and seashore grass (*Puccinellia* sp.) furnish considerable grazing. At the base of the spit the land rises gradually to the high plateau above, the scattered timber giving the appearance of mountain parks. The open portions of this land support a luxuriant growth of bluetop (*Calamagrostis langsdorfii*)

FIG. 1.—VIEW OF KADIAK, SHOWING CHARACTERISTIC TOPOGRAPHY OF THE ISLAND.

FIG. 2.—VIEW OF LOW MEADOW LANDS AT HEAD OF WOMENS BAY, NEAR KADIAK.

often 6 feet tall. At a rough estimate the grass lands in this vicinity comprise about 2,000 acres.

The site of the proposed Finnish colony is on the north side of Kachemak Bay, not far from its head. From the colony site to the head of the bay are extensive tide flats, which are mainly covered with sedges about 2 feet high. The marshy nature of these lands, together with the coarse nature of the forage, makes them of but limited value. Undoubtedly they can be much improved by diking.

The grass lands of the colony site proper consist of about 500 acres of excellent land covered with a luxuriant growth of bluetop 5 to 6 feet high. These lands lie close to the seashore and less than 100 feet above it. Back of these lands are high hills, 500 to 1,500 feet high, the plateau on the top of which consists in part of extensive grass areas. Much of this grass consists of bluetop often 6 feet high. Other areas are pure growths of Siberian fescue (*Festuca altaica*). Interspersed with these are several other good grasses, among them *Agropyron violaceum*, *Alopecurus alpinus*, *Bromus richardsonii*, and *Deschampsia cæspitosa*. These plateau grass lands are apparently very extensive. To render them accessible will, however, require the building of roads or trails up to the easiest slopes. At Anchor Point there is but little grass land near the seashore, but on the plateau behind are considerable areas much like those just described. The plateau at this point is, however, much lower.

An important fact in relation to all of the grass lands of this region is that they are underlaid with coal, which is exposed for miles in the bluffs along the coast. In view of this fact, it is doubtful if title to the land can be gained by homesteading it.

At Kenai there are no naturally grassed lands, except the sand dunes along the beach and the marshes lying inside of them. The dunes are covered principally with beach rye (*Elymus mollis*) and bighead sedge (*Carex macrocephala*). In the brackish marshes occur red fescue (*Festuca rubra*) and Puccinellia. Here also is found poison parsnip (*Cicuta douglasii*), and there is a record of some native cows having been killed by it several years ago.

KADIAK ISLAND.

Kadiak Island is about 100 miles long by 50 miles wide. It is mountainous in character, the hills rising quite abruptly from near the seashore to heights of 1,000 to 3,000 feet (Pl. VII, fig. 1). At the end of July there was still considerable snow at 2,000 feet, but this is said to be quite exceptional.

The island is much cut into by long, narrow bays or fiords, into the heads of which flow streams. In such places are usually quite extensive areas of flat lands, luxuriantly covered with grass (Pl. VII,

fig. 2). The slopes up to 1,500 feet altitude are also well grassed, excepting where there are thickets of alder or willow, but they are usually too steep to utilize otherwise than by grazing. The total area of these hillside lands is much greater than that of the approximately level lands, at least in the proportion of 20 to 1.

On the hillsides the principal grass is bluetop (*Calamagrostis langsdorfii*), which often covers large areas in a pure growth. This was exceptionally fine on hillsides burned over in March, by which means the old straw and moss were destroyed, thus permitting better drainage. In such places this grass is often 6 feet high. On the contrary, if the hills are burned over in June the fire kills the grass roots as well as the moss, with the result that fireweed (*Epilobium angustifolium*) takes possession of the ground.

Other grasses on the hillsides are relatively unimportant, though *Festuca altaica* occurs in the more gravelly lands in some abundance.

On the flat lands before mentioned a tall species of sedge (*Carex cryptocarpa*) forms a broad fringe along the shore of the bays and sloughs, especially on lands which are occasionally covered by tide water. Back of this sedge beach rye (*Elymus mollis*) forms a more or less broad zone (Pl. VIII, fig. 1), often mixed with patches of *Poa glumaris*. In the drier lands bluetop is most abundant.

These three plants furnish the great bulk of the forage on Kadiak Island, and, indeed, in most parts of the Alaska coast, but the bluetop is more abundant than all of the other grasses together.

Bluetop cures very readily, owing to its slender stems and thin leaves, making a sweet and palatable hay. Beach rye cures much less easily, owing to its thick stems. The sedge cures very slowly, even under favorable conditions, owing to its pithy stems. All three of these plants grow so luxuriantly that they yield from 2 to 3 tons of hay per acre.

Of forage plants other than grasses, a lupine (*Lupinus unalaskensis*) and fireweed (*Epilobium angustifolium*) were both abundant. They are readily eaten by sheep. A fern (*Athyrium cyclosorum*) often occupies hillsides to the virtual exclusion of other plants. It is never eaten by animals.

In the immediate vicinity of Kadiak the lands have been quite closely grazed for years past by the village cows. In such closely grazed lands the principal grasses were bluegrass (*Poa pratensis*) and wild barley (*Hordeum boreale*). The latter is not much relished by cattle.

A very similar condition on closely grazed lands was noticed also at Kenai. The facts point to the probability of bluetop being a grass that will give way under close grazing; but as bluegrass readily replaces the native grasses, permanent pastures of the best kind are assured.

FIG. 1.—MOWING BEACH RYE, FRYE-BRUHN RANCH, NEAR KADIAK.

FIG. 2.—ANGORA GOATS, WOOD ISLAND, NEAR KADIAK.

The islands lying adjacent to Kadiak are very similar to it in character, with the exception of Afognak, which, like the northwest corner of Kadiak, is timbered with spruce.

ALASKA PENINSULA AND ADJACENT ISLANDS.

The whole region to the westward of Kadiak might briefly be described as being similar to Kadiak, but entirely devoid of timber, the shrubs more scrubby, and the grass less luxuriant. The land is none the less splendidly adapted to grazing, a large variety of grasses occurring. It is only in favored spots that the grasses are as luxuriant as on Kadiak, though the species are for the most part the same. On the hills occur extensive areas of crowberry (*Empetrum nigrum*), locally called "moss," which in places seriously limits the amount of grazing.

Much of the Alaska Peninsula is far too mountainous to be desirable for stock raising, but where valleys occur near the heads of numerous inlets the land often lies very favorably.

UNALASKA.

This island differs but little in its vegetation from Kadiak, though the plants as a rule are less luxuriant. The principal grasses are silvertop (*Deschampsia cæspitosa*), beach rye, bluetop, and *Calamagrostis aleutica*. The latter occurs but sparingly to the eastward, but is quite abundant on this island.

Some difficulty would be experienced on Unalaska in finding grass sufficiently rank to cut for fodder, especially if a large quantity were necessary. A cultivated field of bluegrass and white clover in the town was, however, as fine as any I have ever seen. Small areas of beach rye are nearly as luxuriant as the same grass farther eastward.

BROWSING LANDS.

On Kadiak Island and to the westward the mountain sides are often covered with a dense growth of alder (*Alnus sinuata*) 3 to 10 feet high, and to a less extent low willows of several species form copses in wet places. These latter especially are said to be eaten readily in winter by cows and sheep, and goats are said to eat any of the deciduous shrubs. In some places these shrubs cover the ground almost to the exclusion of other plants.

In the region to the eastward of Kadiak there are likewise many places where this same alder, together with willows, salmon berry, huckleberry, and other deciduous shrubs, forms a large part of the vegetation. This is especially true of many places about Prince William Sound.

WINTER FEED.

Owing to the damp summer climate, the curing of hay on the Alaska coast is a difficult matter. With three days of favorable weather bluetop will cure perfectly, and where one needs but a small quantity of hay no particular difficulty is experienced in getting it. On the contrary, where a large quantity of winter feed is needed it is practically impossible to secure it. Under such conditions resort must be had to silos. Without question the bulk of the winter feed used in Alaska will have to be silage. The experience of Professor Georgeson and others with beach-rye silage has been entirely satisfactory, and doubtless other plants will furnish an equally good silage.

The following analyses of the three most common grasses or grass-like forage plants of the Alaska coast have been made through the courtesy of the Bureau of Chemistry. Their value can only be accurately determined in connection with digestion experiments. These three plants are bluetop (*Calamagrostis langsdorfii*), sedge (*Carex cryptocarpa*), and beach rye (*Elymus mollis*).

Composition of Alaskan forage plants.

	Moisture.	Ash.	Ether extract.	Crude fiber.	Proteids.	Nitrogen-free extract.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Bluetop	7.18	3.90	1.03	42.94	4.58	40.37
Sedge	5.85	10.65	2.12	25.72	10.32	45.34
Beach rye	11.92	7.51	2.26	30.31	12.71	35.29

UTILIZATION OF SOUTHERN ALASKA GRAZING LANDS.

SHEEP HUSBANDRY.

The only sheep seen in Alaska were on the ranch of the Frye-Bruhn Company near Kadiak, where about 80 head were seen in excellent condition. These sheep are the remnant of 9,000 head which were introduced from Oregon in 1902 and 1903, the remainder having perished. At first sight it would seem that this appalling loss of over 98 per cent is concluisve evidence that sheep raising in Alaska is not likely to prove profitable. Inquiry into the causes of the mortality does not necessarily bear out this conclusion. Five hundred of the sheep were drowned in March, 1903, by being caught at the head of a narrow cove by the incoming tide. One hundred and fifty head were lost by becoming frightened and jumping over cliffs. The rest of those that died succumbed from scab, which broke out in January, 1903. Owing to lack of shelter it was then impossible to dip them, as that treatment in winter would have been equivalent to killing them. The result was that all but about 80 died of the scab. Thus all

the mortality was due to causes entirely preventable. It was interesting to know that several head of sheep which ran wild survived the winter without care.

At Uyak I was informed that 4 head of sheep survived the winter of 1903–4 without care.

Some years since the Alaska Commercial Company had a band of about 50 sheep on Kadiak, the remnant of a considerably larger lot imported from San Francisco. Of the original importation the greater portion died the first winter, some say from scab, others from cold and neglect. At any rate, this venture seems not to have been a success, the last of the sheep having been killed about six years since. Various informants have reported so differently to me on the facts concerned with this that it does not seem advisable to consider it either as evidence for or against the possibility of successful sheep raising. It is worthy of note, however, that both these lots of sheep were imported from the semiarid regions of Oregon and California and brought to a moist and colder country.

There seems to be a general unanimity of opinion in Kadiak that in an ordinary winter sheep can not be safely left without care after the beginning of January. Indeed, many would place the time a month or six weeks sooner. New grass never appears before May 15, and often not until June 1. Therefore, under the best of conditions, sheep will need four and one-half months of feeding and shelter. The superintendent of the Frye-Bruhn ranch, after one winter's experience, thinks it will be more than this.

Another serious difficulty lies in the lateness of the lambing season. It is generally agreed that lambing should not take place before June 1. The lambs will need shelter and feed by December 1 or earlier, unless one takes serious chances of losing many.

Whether sheep raising can be profitable at present under such conditions remains to be demonstrated. The mere fact that sheep in small numbers have wintered without care is no proof that successful sheep husbandry can thus be carried on, nor even that one or two months' feeding should suffice. The risks in such procedure are too great to warrant a careful stock raiser in taking the chances.

Destructive wild animals are no menace to sheep raising on Kadiak and other islands. Eagles may destroy a few lambs, but these birds are easily exterminated. Kadiak bears are too scarce and too easily destroyed to merit consideration. On the mainland wolves may prove troublesome.

In the light of present knowledge one can be safe in saying that sheep can be raised on the Alaska coast if adults are given five months' feed and shelter and the lambs a month more. That such sheep husbandry will be profitable is problematical.

Owing to the damp climate, foot rot is a disease to be feared. Unusual care should therefore be exercised to import only perfectly healthy animals.

While the outlook for successful sheep husbandry is, in my opinion, doubtful, it is desirable that some of the hardy northern breeds be tested. Where browse is abundant it is not unlikely that such animals may prove decidedly profitable.

ANGORA GOATS.

Rev. C. P. Coe, of Wood Island, has several head of Angora goats (Pl. VIII, fig. 2), which have passed the last two winters with but little care. This year his herd has shown very satisfactory increase, and no difficulty is anticipated in wintering the kids. These animals bid fair to be very successful along the Alaska coast wherever there is abundant browse and where the winter snowfall is not too great. From Kadiak westward there can be but little doubt as to their being a success, and even in southeastern Alaska it is altogether likely that they will thrive. Owing to their tractability and the ease with which they are kept, Angora goats should prove most useful animals for the natives as well as for whites.

BEEF RAISING.

Two Seattle companies have already begun to raise beef cattle in southwestern Alaska. The Frye-Bruhn Company have 200 head, mostly Herefords, on Kadiak Island, while another company is beginning operations on Akun Island. The former company began operations with cattle in July, 1903, with about 260 head. During the winter of 1903–4 about 140 head of these were lost, mostly by falling over cliffs. Owing to the fact that the earliest grass appears on the steep southerly slopes, the cattle crowded in such places. In some instances the sod, loosened by the frost, gave way and precipitated them over the cliffs. In other cases the cattle used their horns when crowded, the wounded ones losing their footholds in endeavoring to escape. As precautions more care is now used in selecting their feeding grounds and the cattle have been dehorned.

Cattle of various breeds have been raised for years past at nearly all the settlements along the coast. When they belong to the natives they are forced to exist through the winter with little or no care, eking out an existence by feeding on browse and seaweeds. Milch cows kept by whites are fed from five to six months, as a rule. This winter the manager of the Frye-Bruhn Company ranch is preparing to feed his beef cattle five months or more, and it would seem that such a course is better economy than to keep them half starved on such feed as they can find.

It is possible to raise many times more beef on the Alaska grass lands than the present population there can use. The only other markets available at present are the Pacific coast cities. Whether it will prove profitable to raise beef in Alaska and market it in Seattle and other coast cities remains to be demonstrated. Apparently there is no other outlet for surplus Alaska cattle, but with a sufficiently large supply there seems no reason why in time such a trade should not be remunerative.

Cattle fatten readily in spring on Alaska grasses, and keep in fine condition till late into the fall. Some Herefords slaughtered at Kadiak in July furnished as fine beef as any I have ever seen or eaten.

DAIRYING.

Milch cows of various breeds have long been kept at most of the coast settlements, and the common testimony is that they do exceedingly well while feeding on the green grasses. Professor Georgeson's tests have demonstrated that they keep up an excellent milk flow on beach-grass silage, and doubtless the other grasses are quite as nutritious.

For two reasons I am impelled to believe that the utilization of the Alaska grass lands will yield most profit through dairying: (1) Because of the necessarily long feeding period—five to six months—during which only dairy cows yield a compensating return, and (2) the freight to distant markets on concentrated products like butter and cheese is not a serious factor.

There are many admirable sites for dairy colonies or settlements, not only on Kadiak Island, but also on other islands and on the mainland. Dairying is to be one of the chief industries in the proposed Finnish colony on the Kenai Peninsula. With such an enormous wealth of grass as southwestern Alaska possesses it is difficult to doubt that it will become a great dairy country. It is doubtful if equally good opportunities for colonies of dairy husbandmen can be found in the United States to-day. Certainly there is no place left where 320-acre homesteads of magnificent grass lands can be had for the taking.

RECOMMENDATIONS.

In view of the enormous area of the southwestern Alaska grass lands it seems most advisable that this undeveloped resource be converted into wealth. Perhaps nothing will stimulate this more than a live-stock experiment station. The peculiar problems connected with stock raising in Alaska are likely to prove expensive to pioneers, as indeed has already been proven. There are still many problems confronting the stock raiser which it is clearly the province of an experiment station to solve.

Among the most important lines of work thus presented are the adaptability of different breeds, both of sheep and cattle, to the conditions; the relation of available winter feeds, both to fattening and to milk flow; the investigation of such plants as lupine and fireweed for silage, and the further investigation of forage plants for cultivated fields, especially of legumes.

Such a live-stock experiment station would, in the opinion of the writer, best be located on Kadiak Island, or one of the islands immediately adjacent. The conditions there are fairly representative, these islands being better grassed than most of the regions to the westward, while they have a shorter season than the equally well grassed lands of Cook Inlet. Such an establishment should do much to stimulate the rapid utilization of a great resource.

NOTES ON THE GRASSES AND OTHER FORAGE PLANTS OF THE ALASKA COAST.

GRASSES.

Savastana odorata (L.) Scribn., Vanilla grass.—A sweet-scented grass often used by the Indians in basketry. It occurs in meadows, usually scattered among other grasses, very seldom making a pure growth. This grass has but little forage value.

Savastana alpina (Lilj.) Scribn., Alpine vanilla grass.—Very similar to the preceding, but much smaller and with a denser inflorescence. It was observed only on Kadiak Island, at about 1,000 feet above sea level, but is known to occur quite generally along the Alaska coast, in the mountains.

Phleum alpinum L., Mountain timothy.—This grass was observed at almost every point examined. Luxuriant specimens may be 2 feet high or more, but the grass is usually shorter. Owing to its rather scanty leafage and low growth it has not been considered of agricultural value, but it is worthy of such trial in Alaska.

Phleum pratense L., Timothy.—This important agricultural grass is only sparingly introduced along the Alaska coast. Even where established it shows no tendency to become aggressive, but, on the contrary, appears but poorly adapted to the conditions. A few plants observed were, however, tall and vigorous, suggesting that by selection a variety might be secured which would be agriculturally successful. The possibility of securing a valuable grass by hybridizing this with the preceding species is also worthy of investigation.

Alopecurus alpinus J. E. Smith., Mountain foxtail.—A rare grass on the south Alaska coast, but growing 3 to 4 feet high. While too scarce to be a factor in the amount of native forage, it nevertheless may prove of cultural value, and should be tested.

Alopecurus geniculatus L., Water foxtail.—Infrequent, and of but little forage value.

Arctagrostis arundinacea (Trin.) Beal.—This grass much resembles bluetop, having the same habit and, like it, growing 4 to 7 feet high. It is not uncommon along Cook Inlet and is certainly worthy of testing in cultivation.

Cinna latifolia (Trev.) Griseb., Wood reed grass.—A tall grass with drooping panicles, found mainly in woods or copses. It is not sufficiently plentiful to be of much value.

Agrostis alba L., True redtop.—This well-known grass was observed at but two points—namely, Yakutat and Homer—being clearly introduced at each place. It thrives well and seems to be aggressive. We judge it to be one of the grasses that will prove of high value for grazing in case the native grasses tend to disappear. True redtop should not be confused with the grasses called "redtop" on the Alaska coast. There are two grasses thus misnamed, bluetop (*Calamagrostis langsdorfii*) and silvertop (*Deschampsia cæspitosa*).

Agrostis hyemalis (Walt.) B. S. P., Rough hair grass; *Agrostis geminata* Trin.; *Agrostis æquivalvis* Trin.; *Agrostis mertensii* Trin., and *Agrostis rossæ* Vasey.—The foregoing five species are small grasses which furnish practically no forage.

Agrostis exarata Trin., Whitetop.—This species quite closely resembles true redtop, but has a closer pale green panicle and no creeping rootstocks. The larger forms of it grow 2 or 3 feet high, and under some circumstances may be worthy of cultivation.

Agrostis melaleuca (Trin.) Hitchcock.—Interesting as being the characteristic Alaska coast grass on the sphagnum bogs. Its slender stems, scarce a foot high, furnish, however, but little forage.

Calamagrostis langsdorfii Trin., Bluetop.—The most abundant grass on the Alaska coast, growing luxuriantly from sea level up to 1,000 feet elevation. Extensive areas of this grass are often 6 or 7 feet high, which during the summer months makes traveling toilsome labor. The usual name applied to this grass in Alaska is "redtop," but as the name really belongs to a well-known agricultural grass which is beginning to appear in Alaska, we would suggest "bluetop" as a more appropriate name, the panicle being blue-purple rather than red in color.

Calamagrostis aleutica Trin., Aleutian reed grass.—Found but sparingly at Sitka, Latouche, and Unalaska. Too scarce to be of forage value.

Calamagrostis n. sp.—Kadiak, in low meadows. A small species allied to *C. deschampsioides* Trin.

Deschampsia bottnica (Wahl.) Trin., and *Deschampsia cæspitosa* (L.) Beauv., Silvertop.—These two closely allied species occur mainly in low-lying meadows near the seashore, often indeed in places which

the high tides cover. They furnish excellent grazing, but owing to the nearly leafless stems yield but little hay.

Deschampsia curtifolia Scribn.—A dwarf species occurring on gravelly soil.

Deschampsia atropurpurea (Wahl.) Scheele.—Found at Unalaska and Latouche. It is of no economic importance.

Deschampsia calycina Presl., and *Deschampsia elongata* (Hook.) Munro.—Both these species were found along the railway at Yakutat; undoubtedly introduced.

Trisetum cernuum Trin.—A woodland grass of no economic value collected at Sitka, Yakutat, and Latouche.

Trisetum subspicatum molle (Michx.) Gray.—In rocky soil, scarce. Found at Kadiak and Unalaska.

Avena striata Michx.—A few plants seen only at Kenai.

Melica subulata (Griseb.) Scribn.—Unalaska, on rocky cliff near the seashore.

Poa annua L., Annual bluegrass.—Common in yards and waste places about nearly all Alaska settlements.

Poa stenantha Trin.—A rather common species, but mainly confined to rocky cliffs and gravelly stream banks, and consequently of little forage value.

Poa eminens Presl.—A coarse species 2 to 4 feet high, growing in wet meadows near the seashore. It is not abundant enough to be of importance.

Poa pratensis L., Kentucky bluegrass.—From my observations Kentucky bluegrass seems not to be native along the Alaska coast, but introduced. In places it is abundant, especially about the settlements. It is an important fact that where the native grasses have been displaced bluegrass is one of the principal species to occupy the ground.

Poa nemoralis L.—Frequent, but growing usually on cliffs and therefore of little forage value.

Poa lanata Scribn. & Merrill ined.—A species closely related to *Poa pratensis*, but of coarser growth. It is common at Unalaska, and apparently would be of value in cultivation.

Poa trivialis L.—Apparently native in Alaska, but scarce. We saw it only at Sitka.

Poa leptocoma Trin. var.—Found only at Orca on stream banks.

Poa arctica R. Br.—A low species occurring at Kadiak and Unalaska.

Poa hispidula Vasey.—A tall, rather coarse species, of which a few plants were seen at Seldovia.

Panicularia pauciflora (Presl.) Kuntze.—Found sparingly at Sitka, Latouche, and Yakutat in wet places.

Panicularia americana (Torr.) MacM.—A few plants found near Homer, seemingly native.

Puccinellia sp.—One or more of the obscurely defined species of this genus occurs on low seashores, often in places which the high tide covers. Cows are very fond of this grass, but only in exceptional places is it abundant enough to furnish pasturage.

Festuca rubra L., Red fescue.—Several varieties of this variable grass occur along or near the seashores. In sandy soil it is often abundant enough to be of importance.

Festuca altaica Ledeb.—A densely tufted grass 1 to 2 feet high, forming small tussocks. On the plateau above Kachemak Bay there are large tracts where this is the prevailing grass. Presumably it is valuable forage, but direct observation on this point is needed.

Festuca ovina brachyphylla Schultes.—A very dwarf grass too scanty to furnish forage.

Bromus aleutensis.—Observed only at Unalaska. Rare.

Bromus sitchensis Trin.—A tall, coarse species, often 6 feet high, and the panicles a foot or more long and broad. It is not uncommon near Sitka and deserves trial under cultivation.

Bromus pacificus Shear.—Habit much like the preceding species, and, like it, deserving attention in cultivation.

Bromus richardsoni Link.—Observed only on the plateau above Kachemak Bay.

Bromus hordeaceus L.—Introduced along the railway at Yakutat.

Agropyron tenerum Vasey.—Not uncommon on the Kenai Peninsula. It is likely to prove a valuable hay grass in cultivation.

Agropyron repens (L.) Beauv., Couch grass.—Common in yards and gardens at Sitka, growing 3 to 5 feet high. It seems very well adapted to Alaska conditions and, were it not so difficult to eradicate where once established, might be recommended for trial as a hay grass.

Hordeum boreale Scribn. & Smith, Wild barley.—Common all along the Alaska coast, and about the villages often the commonest grass. Cows seem to avoid it, at least indicating strong preference for the bluegrasses and others.

Elymus mollis Trin., Beach rye.—A very common and valuable grass found along the whole south Alaska coast. It commonly forms a fringe from 10 to 100 feet wide, or sometimes more, just above high-tide mark. In such situations it grows 6 feet high. Where sand dunes are formed, as near Kenai and near Yakutat, this grass is the principal sand binder. In such situations the heads are often short and thick, the florets being somewhat proliferous. This form has been called *Elymus capitatus* Scribn., but it is merely a diseased state of *E. mollis*, both the typical elongated and the condensed heads often being found on the same plant.

Elymus borealis Scribn.—A grass confined to southeastern Alaska and of little value.

SEDGES.

Carex cryptocarpa Meyer.—The most valuable sedge for forage along the Alaska coast, frequently covering large areas. In favorable places it grows 4 to 5 feet high. On the Yakutat plains it is an important element of the flora. Near Kadiak and near Sitka it was found covering extensive tracts of low-lying land along the seashore, the plant occupying the ground between the zone of beach rye and ordinary high-tide mark. Quantities of it were cut for feed on the Frye-Bruhn ranch, but owing to the pithy stems it dries very slowly.

Carex macrochæta Meyer.—A small species common on the drier land near the sea level. Cattle graze upon it readily. It is the most important dry-ground sedge.

Carex macrocephala Willd.—On the sand dunes at Kenai, where it is of some importance as a sand binder.

Carex sitchensis Presc.—A tall, abundant species, but usually growing in very wet places, so that it can scarcely be utilized.

LEGUMINOUS PLANTS.

Lupinus unalaskensis Wats., Lupine.—This lupine is exceedingly abundant from Cook Inlet westward, often covering large areas in a nearly pure growth. In favorable places the plants are 3 feet high. Sheep eat it readily while green. Inasmuch as this is by far the most abundant leguminous plant in south Alaska, it is most desirable to ascertain the value of this plant as silage. It is too fleshy to be cured as hay.

Lathyrus maritimus (L.) Bigel., Beach pea.—Common on high seabeaches, but owing to its low growth it can not be harvested. Cattle feed readily upon it. The seeds are quite large and sweet, so that it is often used as human food.

Lathyrus paluster L., Swamp pea.—A much more slender plant than the foregoing and much less plentiful. Near Kadiak, however, several considerable patches of it in nearly pure growth were observed.

Vicia sitchensis Bong. (*V. gigantea* Hook.).—Observed only near Sitka. A very tall and leafy species, often 6 to 8 feet high, clambering over bushes. The flowers are ochraceous. The plant deserves trial in cultivation.

OTHER PLANTS OF FORAGE VALUE.

Fritillaria kamtschatcensis (L.) Ker., Wild rice.—The subterranean bulblets of this plant, which resemble a mass of rice grains,

were formerly much used as food by the natives. In the few places where hogs are kept they feed greedily upon these bulblets. The plant prefers the low-lying lands near the seashore.

Epilobium angustifolium L., Fireweed.—When hillsides are burned over in June, the intensity of the fire is usually such as to destroy grass roots. Under such circumstances a nearly pure crop of fireweed is likely to follow. Sheep eat this plant readily when green. It is desirable to test the value of the plant as silage, as its great abundance often makes its harvesting an easy matter.

THE COMPOSITION OF SILAGE MADE FROM BEACH GRASS.

Beach grass (*Elymus mollis*) constitutes for the most part the silage material in Alaska, at least in the coast region. It is a very rank, coarse grass, and in most places yields a heavy tonnage to the acre. It grows on the flats or deltas built up by streams, at the head of bays and inlets, and occasionally along a stretch of flat, sandy beach just beyond the reach of high water, though in many places it is partly flooded at extreme high tides. As a rule, it forms a pure growth, though occasionally, particularly in low places, it is mixed with sedges.

This grass has been used to fill the station silo at Sitka every year since it was built. This year a sample which had been in the silo for just one year and taken from the middle of the silo near the bottom was sent to the Bureau of Chemistry for analysis. Doctor Wiley's letter, attached hereto, shows that this silage is exceedingly rich in nutritive elements, particularly protein, and the writer can testify from experience that it makes good feed for cattle.

SEPTEMBER 1, 1904.

DR. E. W. ALLEN, Acting Director,
Office of Experiment Stations, Department of Agriculture.

DEAR SIR: Below is given the analysis of the sample of beach-grass silage from C. C. Georgeson, Sitka, Alaska, which you sent us under date of August 15.

The sample contained 69.77 per cent water. Analysis of the dried sample is as follows:

	Per cent.
Fat	3.32
Protein	10.64
Ash	6.89
Crude fiber	34.64
Nitrogen free extract	44.51
Total	100.00

Respectfully,

H. W. WILEY,
Chief Bureau of Chemistry.

ANALYSES OF ALASKAN SOILS.

Prof. Milton Whitney, Chief of the Bureau of Soils, has very kindly analyzed several samples of soils sent him for investigation. Sixteen of these samples are from the experiment station at Copper Center. Table 1 gives the result of a mechanical analysis of these samples, and it also shows at which depth they were taken and their relative positions with reference to the Copper River. Most of them are deficient in organic matter, though two samples appear to be very rich in humus.

Table 2 gives the chemical analyses of these samples, and Professor Whitney's estimate of their value is indicated in his letter which refers to the subject.

Another sample of soil was sent to the station by a settler near the mouth of the Stikine River. Professor Whitney's letter on this subject gives the result of his examination.

The soils in Alaska vary so exceedingly that the examination of particular samples can not give us an idea of the character of the soil except in the immediate vicinity where the samples were taken.

U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF SOILS,
Washington, D. C., March 14, 1903.

DR. A. C. TRUE, Director,
Office of Experiment Stations, Department of Agriculture.

DEAR SIR: We inclose herewith results of mechanical and chemical analyses of a number of soils forwarded by you to this Bureau some time since, these soils having been collected by Professor Georgeson in Alaska. From a physical point of view, these soils are interesting in showing unusually small amounts of medium-sized grains, on the whole. Three of them, Nos. 7654, 7655, and 7656, contain unusually large quantities of organic matter, and we would be inclined to think that they can be successfully worked only with especial care as to their drainage. The chemical analyses show no unusual features, as they all contain apparently enough of the essential mineral plant foods to supply the needs of the ordinary agricultural crop.

We would especially call your attention to Nos. 7654, 7655, and 7656 again, on account of a large amount of nitrogen present in these soils, and it is our opinion that they might be expected to respond favorably to applications of lime, if this substance can be economically obtained.

Very truly, yours,

MILTON WHITNEY, *Chief of Bureau.*

TABLE 1.—*Mechanical analyses of soil samples from Copper Center Station, Alaska.*

[Fine earth.]

No.	Locality and description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
		P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7642	(1) From third bench on Copper River, 0–6 inches	1.37	0.10	0.60	0.48	4.02	17.80	71.22	5.42
7643	(2) Subsoil of No. 7642, 6–12 inches	.65	.06	.48	1.46	8.38	15.48	68.12	5.76
7644	(3) Subsoil of No. 7642, 12–18 inches	.67	.14	.78	2.36	16.18	27.16	39.02	14.50
7645	(4) Subsoil of No. 7642, 18–24 inches	.49	1.80	1.32	2.80	16.32	24.74	38.96	14.50
7646	(5) From second bench, near grain plats, 0–6 inches	5.80	.00	.30	.50	5.64	26.78	53.30	13.38
7647	(6) Subsoil of No. 7646, 6–12 inches	3.75	.00	.34	1.30	9.70	22.76	45.76	19.80
7648	(7) Subsoil of No. 7646, 12–18 inches	.80	Trace.	.32	1.62	16.22	28.40	41.08	11.92
7649	(8) Subsoil of No. 7646, 18–24 inches	.26	.00	.26	2.08	15.52	29.78	42.04	9.64
7650	(9) From first bench, near grain plats, 0–6 inches	2.58	.24	.28	.28	4.34	24.66	55.30	14.94
7651	(10) Subsoil of No. 7650, 6–12 inches	1.45	.00	.32	.20	11.98	54.28	28.48	4.86
7652	(11) Subsoil of No. 7650, 12–18 inches	1.26	.04	.08	.08	7.52	31.72	58.12	2.44
7653	(12) Subsoil of No. 7650, 18–24 inches	1.19	.00	.20	.08	3.22	20.08	72.56	3.22
7654	(13) From first bench, on lower ground, 0–6 inches	43.47	.98	6.20	5.20	17.90	20.14	34.62	14.78
7655	(14) Subsoil of No. 7654, 6–12 inches	30.38	1.94	5.48	4.46	12.30	20.56	41.32	13.90
7656	(15) Subsoil of No. 7654, 12–18 inches	21.00	.40	1.56	1.48	5.98	11.54	55.98	22.70
7657	(16) Subsoil of No. 7654, 18–24 inches	2.39	.04	.46	.28	1.62	3.96	52.24	41.20

TABLE 2.—*Chemical analyses of soils from Copper Center Station, Alaska.*

Laboratory No.	Sample No.	Lime (CaO).	Potassium (K_2O).	Phosphoric acid (P_2O_5).	Nitrogen (N).
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
7642	1	2.16	0.21	0.32	0.126
7643	2	2.05	.26	.18	.070
7644	3	2.47	.41	.12	.074
7645	4	2.60	.32	.09	.056
7646	5	3.18	.21	.18	.330
7647	6	4.99	.21	.14	.232
7648	7	3.93	.22	.14	.070
7649	8	3.88	.24	.14	.056
7650	9	3.10	.23	.14	.145
7651	10	3.15	.24	.14	.077
7652	11	3.00	.15	.11	.063
7653	12	3.30	.13	.07	.126
7654	13	5.75	.09	.19	1.250
7655	14	5.04	.11	.13	1.150
7656	15	5.02	.29	.12	.561
7657	16	6.36	.45	.11	.147

AUGUST 26, 1904.

Doctor ALLEN, Acting Director,

Office of Experiment Stations.

DEAR SIR: We have examined the sample of soil collected by K. J. Kruyg from near the mouth of the Stikine River, Alaska, forwarded to this Bureau some time since by you, obtaining the following results for the principal mineral constituents:

	Per cent.
Lime (CaO)	1.55
Potassium (K_2O)	1.22
Phosphoric acid (P_2O_5)	.49
Nitrogen (N)	.30

You will see from the analysis that so far as can be judged by this method of examination the soil is well supplied with the principal mineral plant food constituents. This sample shows 3.2 per cent of organic matter, much of which is in the form of rootlets, and therefore can not be as readily made use of by plants as if in a more decomposed state.

The texture of the soil is that of a silty loam. Probably 75 to 80 per cent of the particles are of the size called "silt." There is a very small percentage of the finer grades of sand and probably 15 per cent of clay present. This soil resembles some of the loess soils of the Mississippi Valley, especially those which have been formed by the washing of the loess from the bluffs and its redeposition along the streams. These soils are usually quite productive and yield good crops of corn, wheat, oats, potatoes, peas, tomatoes, cabbage, and other truck and market-garden crops, as well as orchard fruits. While it is not possible from the small amount of data to draw any very definite conclusions, we should expect this soil, under good drainage conditions, suitable management, etc., to prove a very productive one.

Very truly, yours,

MILTON WHITNEY, *Chief of Bureau.*

WORK AT SITKA STATION.

The cultural work is detailed in the following notes. The weather conditions were so unfavorable that no crops of any kind reached the perfection attained in former years. This station is now devoted chiefly to the testing and propagating of fruit trees, berry bushes, and ornamentals of such kinds as give promise of succeeding in Alaska. They will then be distributed to the other stations and to others in all parts of the Territory who will agree to cooperate with us in the work of ascertaining what can be grown. The station will begin the distribution of raspberries, currant bushes, and some few fruit trees in the spring. Wild species of raspberries and currants are found more or less abundantly in the lower mountain regions of the coast range, and cultivated varieties do well everywhere in the coast region, but it is still uncertain if they can be grown in the interior. For purpose of propagation the station has procured small stocks of early and hardy varieties of apples and cherries and plums from the experiment stations in South Dakota, Iowa, and Minnesota, and from nurseries at Yankton, S. Dak., and Lake City, Minn. The notes herewith show that their growth this year has not been all that could be wished, because of the abnormally cold, backward season.

The soil at this station is new and as yet not in good condition for fruit. For this reason it will be necessary to grow crops which will improve the tilth, such as potatoes, soiling crops, and the like, for some time. With this in view, potatoes and cabbage were planted on about 2 acres and oats sown on 2 acres more. The potatoes

yielded a fourth of a crop, the cabbages did not head, and the oats did not mature.

A small plantation was made of the native cranberry, which is doing well, though it had no fruit this year, and a few plants of the Eastern cranberry were secured from the Wisconsin Cranberry Growers' Association. It is difficult to get plants here alive, but some few are doing fairly well.

Strawberry plants sent here by mail are nearly always dead on arrival; but a small collection of varieties, most of which grew well in 1903, was obtained. Eighty per cent of these were winterkilled last winter.

This year a splendid start was made with the native Alaskan strawberry. Its home is on the bleak sandy beaches from Muir Glacier to Prince William Sound. It is a rampant grower, but a very shy bearer. The fruit is, however, of very fine quality and often as large as a thimble. It is hoped to produce one or more hardy varieties from crosses. Attempts at hand fertilization have not been a success so far, because the native plants are out of bloom before the cultivated varieties begin blooming. To aid in such work a small propagating house, 10 by 20 feet, with a workroom attached, 10 by 15 feet, was built. It is not quite finished at this writing.

Some fertilizer experiments were made on a small scale with oats and vegetables, using combinations of lime, fish guano, nitrate of soda, muriate and sulphate of potash, and superphosphate. Experiments with the same fertilizers in a series of pots, or rather box culture, with wheat, barley, oats, and buckwheat, were made, but since the crops failed the experiments were of little value. They proved this much, however, that the growth was decidedly more vigorous where a heavy dressing of caustic lime was applied. This was particularly the case on a piece of raw, peaty soil seeded to common oats. It was treated with 300 pounds muriate of potash to the acre, and a strip through the center was, in addition, treated with caustic lime at the rate of a ton to the acre. The limed strip produced a uniform and fair growth, while on the plats not limed the plants turned yellow and died.

Lime has been used sparingly because it is expensive. It costs here at Sitka $4.50 a barrel of 200 pounds. A ledge of limestone has been located some 14 miles from the station and a supply will be quarried during the winter. By the aid of the launch and scow, it can be hauled home and later burned for the needs of the station.

During the year considerable progress was made in extending the stock of fruit trees, bush fruits, ornamentals, etc., in the nursery.

The present condition and amount of growth of the different varieties are shown below:

APPLES.

Duchess, 19 trees. May 2, uninjured by frost, buds swollen. October 10, 1 foot new growth, new wood very soft. This variety promises to do very well in this climate.

Red Astrachan, 18 trees. May 2, new wood one-third winterkilled. October 10, 3 inches new growth, not thrifty.

Yellow Transparent, 20 trees. May 2, tips killed. October 20, new growth 7 inches; trees look well. Wood too soft to withstand severe winter.

Maiden Blush, 16 trees. May 2, last year's growth killed back three-fourths. October 10, very poor, practically no new growth.

Early Harvest, 18 trees. May 2, tips killed back by cold. October 10, trees healthy, but only 2 inches new growth.

Raspberry, 18 trees. May 2, tips winterkilled. October 10. 4 inches growth. Gives fair promise.

Sylvan Sweet, 18 trees. May 2, tips killed, buds starting to open. July 1, 9 trees have good color, very little new growth. October 10, in fair condition for winter, 6 inches new growth.

Eureka, 19 trees. May 2, new wood killed back one-half. July 1, 4 trees dead, leaves small on remaining trees, very unthrifty. October 10, trees made fair growth; average 5 inches. In fair condition.

Tetofsky, 20 trees. May 2, tips injured. July 1, very backward; 3 inches growth. October 10, the growth on this variety for the season is not thrifty. Grew none after July 1.

Brier Sweet, 20 trees. May 2, tips killed. July 1, all trees nearly dead. No new growth October 10. Very poor, barely alive. No growth this season.

Lowell, 17 trees. May 2, last season's growth killed back one-half. July 1, 2 inches new growth. Trees look well October 10. Season's growth 5 inches; good promise.

Standard Hibernal, 3 trees. May 2, uninjured by cold. July 1, 2 inches growth. October 10, very thrifty. Season's growth, 16 inches.

Hyslop, 1 tree. May 2, tips injured, buds swelling. July 1, 1½ inches growth. October 10, vigorous looking. Season's growth, 6 inches.

Whitney Crab, 18 trees. May 2, tips killed. July 1, good color, 2 inches growth. September 1, 10 inches growth. October 10, season's growth, 12 inches. In fair condition for winter. Best of the crab apples.

Martha, 20 trees. May 2, uninjured, buds swollen. July 1, 4 trees unthrifty, others making some growth. October 10, average growth for season, 10 inches. Three of these trees will probably die before spring.

Transcendent, 3 trees. May 2, uninjured, buds swollen. July 1, 4 inches new growth. October 10, trees do not look very well. Very little growth since July 1.

These apples have made a very good showing under the adverse conditions. The new growth of last season did not harden up sufficiently to withstand the severe cold of the winter. The ground heaved badly when frozen, which caused the tearing and severe injury to the root system. This season has been an extremely wet and backward one for the trees to regain their normal vigor.

Standard apples planted this season.—Benoni, 5 trees, set July 1. All alive and in leaf. October 10, 6 inches growth.

Early Strawberry, 5 trees, set June 3. July 1, nearly in full leaf. October 10, 9 inches new growth; very promising.

Fanny, 5 trees, set June 3. July 1, in leaf. October 10, season's growth, 9 inches.

Golden Sweet, 5 trees, set June 3. July 1, coming out. July 16, in full leaf. September 1, 3 inches growth. October 10, 5 inches new growth. Promises to do well.

Primate, 5 trees, set June 3. July 1, coming out. July 16, in full leaf. September 1, 3 inches growth. October 10, 5 inches new growth.

Sops of Wine, 5 trees, set June 3. July 1, buds nearly open. July 16, nearly in full leaf. September 1, 2 inches growth. October 10, season's growth, 4 inches.

Summer Rose, 5 trees, set June 3. July 1, coming out. July 16, in leaf. September 1, 3 inches growth. October 10, season's growth, 5 inches; promises well.

Sweet Bough, set June 3. July 1, buds nearly open. July 16, in full leaf. September 1, 6 inches growth. October 10, season's growth, 12 inches. This variety made the strongest growth of the standard trees set this season.

Williams Favorite, 5 trees, set June 3. July 1, coming in leaf. July 16, leaf in full. September 1, 3 inches growth. October 10, growth for the season, 5 inches.

Dwarf trees.—Early Harvest, 3 trees, set June 3. July 1, buds opening. July 16, nearly full leaf. September 1, new growth, 4 inches. October 10, season's growth, 4 inches.

Fanny, 3 trees, set June 3. July 1, buds swollen. July 16, leaves nearly full grown. September 1, new growth, 4 inches. October 10, new growth for season, 6 inches.

Golden Sweet, 3 trees, set June 3. July 1, buds well advanced. July 16, in leaf. September 1, 3 inches new growth. October 10, season's growth, 4 inches.

Keswick Codlin, 3 trees, set June 3. July 1, buds swollen. July 16, leaves nearly full grown. September 1, 3 inches new growth. October 10, 4 inches season's growth.

Primate, 3 trees, set June 3. July 1, leaves coming out. July 16, in full leaf. September 1, 4 inches growth. October 10, 6 inches new growth.

Red Astrachan, 3 trees, set June 3. July 1, in leaf. July 16, in full leaf. September 1, average growth, 3 inches. October 10, average season's growth, 6 inches.

Tetofsky, 3 trees, set June 3. July 1, buds scarcely swollen. July 16, in leaf. September 1, no growth. October 10, 3 inches new growth.

Yellow Transparent, 3 trees, set June 3. July 1, buds well advanced. July 16, in full leaf. September 1, 3 inches growth. October 10, 4 inches new growth.

Sweet Bough, 3 trees, set June 3. In leaf July 1. July 16, in full leaf. September 1, 6 inches new growth. October 10, season's growth, 14 inches. Vigorous grower; gives good promise.

These varieties were planted in well-drained gravelly soil. Were received in good condition, and made a good start, considering season and lateness of planting.

Apple grafts.—Grafts of 1903: All new wood was killed back one-half. New growth this season averages 15 inches. Very tender for winter weather. June 1, Lowell on Wild Crab (crown), 2 coming in leaf. Lowell on Wild Crab (whip), 2 growing. Martha on Wild Crab (crown), 3 growing. Red June on Wild Crab (whip), 1 growing.

Apple grafts made in February from Alaska-grown scions on seedling stock: The wood of these scions was very soft and the seedling roots were 2 years old, making it very difficult to get the grafts to take. About 25 per cent grew. The growth was weak and the wood is not mature enough to stand severe freezing.

October 10, Maiden Blush 2, Red Astrachan 23, Duchess 16, Raspberry 20, Yellow Transparent 15, Red June 1, Sylvan Sweet 36, Eureka 1, Martha 28, Whitney 20, Early Harvest 16, Whitney on Native Crab 4.

Scions from Iowa Experiment Station: Ninety-seven per cent of these grafts grew. Northwest Greening 2, Northwest Greening on Native Crab 1, Malinda 1, Hibernal 7, Wealthy 5, North Star 5, Walbridge 4, Patten Greening 5, Princess Louise 8, Ansim 7, Okabena 3, Brier Sweet 5, and Green Sweet 2.

Apple grafts received from Jewel Nursery, Lake City, Minn.:

Bode, 50 received, 49 grew; Hibernal, 50 received, 42 grew; Longfield, 50 received, 49 grew; Lyman Prolific, 50 received, 31 grew; Jewel Winter, 20 received, 10 grew; Minnesota, 20 received, 10 grew; Virginia, 20 received, 9 grew; Wealthy, 50 received, 44 grew; Yellow Transparent, 50 received, 49 grew.

Received from Yankton Nursery, Yankton, S. Dak.:

Peerless, 7 trees, set May 5. June 15, in full leaf. July 1, all growing nicely. August 15, 4 inches new growth. October 10, look well; grown little since August 15.

Duchess, 8 trees, set May 5. June 15, in full leaf. July 1, growing thriftily. August 15, new growth 6 inches. October 10, season's growth 8 inches. Trees thrifty.

Wealthy, 6 trees, set May 5. June 15, not quite in full leaf. July 1, all growing. August 15, 3 inches new growth. October 10, season's new growth 5 inches.

Patten, 7 trees, set May 5. June 15, in full leaf; growing. July 1, very good growth; thrifty. August 15, 4 inches growth. October 10, looks well, but has grown but little since August 15.

Hibernal, 7 trees, set May 5. June 15, all growing. July 1, 3 inches new growth. August 15, 10 inches growth. October 10, season's growth 13 inches; very promising.

Jessie, 7 trees, set May 5. June 15, all growing. July 1, 3 inches growth. August 15, 12 inches growth. Very thrifty. October 10, season's growth 14 inches.

June Berry, 13 plants. May 2, uninjured by frost, buds well advanced. July 1, very thrifty, 3 inches growth, in bloom. September 1, some fruit, coloring up slightly, new shoots 15 inches long. October 10, thrifty, season's growth 18 inches; some fruit matured.

CHERRIES.

English Morello. May 2, one-third last year's growth winterkilled, 12 trees alive. June 1, very backward. July 1, 10 trees alive, but 1 vigorous. September 1, average growth 5 inches.

Ostheimer, 15 trees. May 2, tips winterkilled. June 1, buds well advanced. July 1, backward; more vigorous than English Morello; 2 trees in bloom. September 1, average growth 6 inches. October 10, average growth 8 inches. Trees vary greatly in growth; no fruit set.

Early Richmond, 19 trees. May 2, new wood killed back one-third. June 1, buds barely begun to swell. July 1, all growing; not vigorous. September 1, average new growth 12 inches. October 10, season's growth 15 inches. This variety came out and is the most promising of any at close of this season.

Dyehouse, 19 trees. May 2, tips winterkilled. June 1, buds well advanced. July 1, all growing very slowly. September 1, 5 inches new growth. October 10, trees look very well. Season's growth averages 7 inches.

Cherry grafts from Jewel Nursery, Lake City, Minn.: 20 Surprise planted, 4 lived; 20 Compass planted, 20 lived.

PLUMS.

Forest Garden, 10 trees. May 2, new wood all killed. June 1, lower buds alive; begun to swell. July 1, 9 trees started new growth, very backward. September 1, new shoots 12 inches long. October 10, new growth very spindling; too tender for winter weather.

Hawkeye, 10 trees. May 2, all last year's growth winterkilled. June 1, buds swelling. July 1, some growth; leaves very yellow; unthrifty. September 1, new growth 12 inches; very tender. October 10, 7 trees very poor; will probably die.

Red June, 8 trees. May 2, last year's growth all killed, trees badly injured. June 1, lower buds show life. July 1, few leaves; very yellow. September 1, new growth 12 inches; poor. October 10, season's growth 15 inches. While this variety made the greatest growth, it will hardly survive the winter.

De Soto, 9 trees. May 2, last year's wood all dead. June 1, lower buds show life. July 1, very poor; leaves yellow. October 10, season's growth 12 inches. Very poor promise.

The plums were more severely injured by the cold than were the other kind of trees.

May Day, 4 trees, set May 18. July 1, growing nicely. September 1, 8 inches new growth. October 10, season's growth average 10 inches. Trees small, but thrifty.

Bixby, 2 trees, set May 18. July 1, doing well. September 1, very slow growing. October 10, 2 inches growth. Very poor.

Sayles, 2 trees, set May 18. July 1, growing very well. September 1, new growth 12 inches. October 10, season's growth averages 15 inches. Trees vigorous.

Rollingstone, 1 tree, set May 18. July 1, making fair growth. September 1, new growth 2 inches. October 10, 3 inches new growth. Unthrifty.

Wyant, 2 trees, set May 18. July 1, making good growth. September 1, new shoots 12 inches long. October 10, season's new growth average 15 inches. Very thrifty.

Tomahawk, 1 tree, set May 18. September 1, leaves good color; no growth. October 10, very little growth; looks well.

Fifty grafts Aitkin, planted May 25, 22 growing; 20 grafts Rollingstone, planted May 25, 19 growing.

Grafts from scions received from the Iowa Experiment Station. Only 25 per cent of these grafts grew.

Mankato 1, Ames 1, Hunst 1, Wolf 1, Odegard 1, *Prunus besseyi* on Plum 3, Bestovall 1, Beatty 1.

These scions were put on piece roots taken from trees that had been killed back during winter. The roots were too old to be successfully grafted.

BUSH FRUITS.

Blackberries.—The station has a few bushes of Turner, Fuller, Colorado, Snyder, and Taylor. The canes of each were winterkilled to the ground last year. The growth was thrifty this season, many of the canes being 3 feet long. To produce fruit the blackberry will probably need winter protection in this climate.

Raspberries.—Exposed bushes of the variety common to the gardens about the town (Cuthbert?). Bushes somewhat protected bore well, but somewhat later than normal. We have a large number of this variety for distribution.

The canes of both Miller and Loudon were winterkilled to the ground. Made good growth this season, having canes 4 feet long.

This season a few bushes of each variety were added to the stock. Champlain, Superlative, and Orange. These were in poor condition when received and made but little growth this season.

Currants.—Currant bushes made a very good growth this season, but produced little fruit. The clusters were not well filled, and the berries were under size.

Fay Prolific. No winter injury. June 1, full leaf and bloom. September 1, new wood 18 inches long; very little fruit. October 10, season's growth 2 feet; wood well hardened.

Victoria, 2 plants. June 1, in bloom. September 1, fruit ripe; larger berries than other varieties. Two feet new growth. October 10, wood in good condition.

Ruby Castle, Manitoba Amber, and Crandall developed about equal to the previous-named varieties, except that they produced no fruit.

There was added to the list this season 10 plants each of Black Champion, Lee Prolific, Red Cross, and Wilder. These were in bad condition when received and were slow starting. Average growth, 6 inches.

There are about 1,200 plants started from cuttings this spring. These are to be distributed.

Strawberries.—The past winter was a severe one on strawberry plants, because of the heaving of the ground. The beds were covered with spruce boughs, but not heavy enough to prevent the freezing of the soil, the snowfall being unusually light.

The station has a few plants of Bismarck, Lady Thompson, Enhance, Excelsior, Saunders, and Haverland. The Bismarck came through the winter in the best condition of the tame berries. The wild native berries were not injured by the winter weather. The native plants are prolific growers and bloom well, but the flowers are imperfect. The tame and wild plants were set in alternate rows last year with hopes that they would cross-fertilize, and thus we might get berries on the wild species. The tame varieties produced but few blooms this season, but a few berries were gathered from the wild vines, which are undoubtedly from bloom cross-fertilized. It is hoped we can start plants from this seed.

Cranberries.—The few plants received from Wisconsin and set in spring of 1903 came through the winter in fair condition and have made some growth this season. A few plants were received this summer and planted out, but it is doubtful if these have started enough to survive the winter.

The native Alaskan cranberry (*Vaccinium vitis-idæa*) set out this spring has made excellent growth and gives promise of yielding well to cultivation. The *Oxycoccus oxycoccus* set out last year died during the winter. No new plants have been set this season. They do not promise to be prolific bearers. Seed of eastern berries planted in flats doing nicely.

Gooseberries.—A few bushes of gooseberries are being grown. The varieties are uncertain, having been obtained from the gardens of Sitka. They grew well this season. We have 100 young plants grown from cuttings of these bushes.

This spring were planted 10 each of Industry, White Smith, Columbus, Red Jacket, Smith Imperial, and Triumph. These were in bad shape when received. Only about half grew.

ORNAMENTALS.

Bittersweet Creeper, 1 plant. Tips winterkilled. June 1, buds swelling. July 1, leaves yellow; very little growth; bloom buds swelling. October 10, nearly dead; will not survive the winter.

Lonicera alba rosa, 3 plants. May 2, buds swelling. June 1, full leaf. July 1, 4 inches new growth; bloom buds swelling. October 10, does not look well.

Siberian wild olive, 2 plants. June 1, buds beginning to show life. July 1, very poor. October 10, will probably not survive the winter.

Sand cherry, plant uninjured by cold. June 1, well advanced. July 1, not thrifty. October 10, season's growth 4 inches. Poor condition.

During the season the following ornamentals have been set up in the nursery: 1 *Spiræa salicifolia*, 1 caragana, 1 *Spiræa van houtii*,

10 common lilac, 1 white lilac, 1 purple lilac, 1 *Spiræa sorbifolia*, 1 Tartarian honeysuckle, 1 hydrangea, 1 *Spiræa aurea*, 1 high bush cranberry, 1 *Rhamnus typhina*, 1 *Berberis vulgaris*, 100 Buffalo berry, 1 *Lonicera tartarica*, and 10 Eglantine and 10 *Rosa rugosa*. Most of the plants have done very well this season considering the conditions of the weather.

VEGETABLES.

Beans.—Broad Windsor, seeded June 1. June 11, germinated well; strong plants. July 1, 5 inches high. July 15, 8 inches high; good color. August 15, in bloom. September 16, pods 2 inches long. The plants were killed by frost September 23, before the beans were large enough for use.

Vicia faba, seeded June 7. Varieties Nos. 10433 and 10541 were up June 20. Nos. 10426, 10439, 10440, and 10442 came up June 26. No. 10443 came up June 28. Nos. 10423, 10444, and 10445 very backward. Other varieties doing very well, 3 inches high. August 15, all varieties in bloom. September 16, No. 10433 2 feet high, few blossoms; No. 10439 2 feet high, full of bloom; No. 10440 15 inches high, full of bloom; No. 10442 15 inches high, plants dead; No. 10443 18 inches high, lower leaves and bloom dead; No. 10444 18 inches high, bloom dead; No. 10445 18 inches high, plants thrifty, no bloom; No. 10446 2 feet high, some bloom, few pods set; No. 10536 full bloom; No. 10540, some bloom, few pods set; No. 10541, bloom dead, leaves turning yellow. The growth of these plants was checked by frost September 23.

Early Refuge, seeded June 1, were very backward and irregular in germinating; plants very weak and unthrifty; all died.

Early Mohawk, Extra Early Red Valentine, and Extra Early Challenge Black Wax, germinated and grew as did the Early Refuge; very few plants produced second leaves.

Beets.—Extra Early Eclipse Blood Turnip, seeded May 23. Germinated June 14. July 16, growing very slowly. August 15, growth very slow, sending up seed stalks.

Dark Red Turnip, seeded May 23. Came through the ground June 11, growth very slow. August 15, small, sending up seed stalks.

Crimson Globe, seeded May 23. Broke ground June 13. Acted same as other varieties.

Brussels sprouts.—Dwarf Improved, seeded in hotbed May 12, germinated May 18. June 1, plants making slow growth; seeded in open ground. Plants from hotbed reset to open ground May 28. July 1, making very slow growth. August 15, very little growth, no promise of developing sprouts.

Cabbage.—Danish Ball Head, seeded in hotbed April 25, germinated April 30. June 1, most advanced of any variety in the bed. Seed planted to open ground. June 10, plants reset from hotbed to open ground. July 16, plants seeded in open ground; growing slowly. Those transplanted show effect of cold by turning purple. August 15, no promise of heading.

Early Jersey Wakefield, seeded in hotbed April 25. In open ground June 1. Plants nearly equal to Danish Ball Head; not vigorous. June 15, seed in open ground germinated; June 10, plants transplanted to open ground from hotbed. July 16, plants seeded in open ground growing very slowly; those transplanted seem in better condition than those of any other variety. August 15, none heading.

Extra Early Express, seeded in hotbed April 25, germinated May 4. Seeded in open ground May 31, germinated June 15. Plants transplanted from hotbed June 10. Plants not so strong as those of other varieties. Plants seeded in open ground July 16, growing very slowly. Those transplanted nearly all dead.

Early Dwarf Flat Dutch, seeded in hotbed April 25, up May 2. Seeded in open ground May 31, up June 15. Transplanted to open ground June 10. July 16, this variety seems to withstand transplanting best. August 15, none heading.

Improved Stonemason, seed did not germinate.

Henderson Early Summer, seeded in hotbed April 25, came up May 2. Seeded in open ground May 31, came up June 15. Germinated very poorly, transplanted June 10. July 16, plants very poor; those seeded in open ground equal to those set from hotbed. August 15, none heading.

Large Late Flat Dutch, seeded in hotbed April 25, germinated May 2. Seeded in open ground May 31, germinated June 16; transplanted from hotbed June 10. July 16, plants very poor. August 15, none heading.

Premium Drum Head, seeded in hotbed April 25, germinated May 2. Seeded in open ground May 31, came up June 16. Plants transplanted to open ground June 10. Very little growth. August 15, none heading.

Cauliflower.—Snowball, seed from Denmark, seeded in hotbed April 25, germinated April 30. Seed germinated poorly; small percentage of plants grew; transplanted to open ground June 10; grew very little; developed no flowers.

Carrot.—Scarlet Horn, seeded May 25, came up June 13. July 16, 1½ inches high, good stand, growth slow. August 15, practically no growth since July 16; sending up seed stalks.

Oxheart, Long Stump Rooted, and Chantenay developed the same as did Scarlet Horn. All seeded and germinated the same dates.

Celery.—Golden Self Blanching, seeded in hotbed April 25, germinated May 20. June 15, making slow growth. July 16, plants transplanted to open ground. July 30, plants set in open ground nearly all dead; plants left in hotbed growing nicely. August 30, plants in hotbed doing well, 12 inches high. September 15, 15 inches high; very good in quality.

Kale.—Dwarf Green Curled Scotch, seeded in hotbed April 25, up April 30. June 1, plants thrifty. Transplanted to open ground June 10; plants grow very slowly. August 15, many plants sending up seed stalks.

Dwarf German, seeded in open ground May 20, germinated June 1. July 1, growing nicely. August 15, very good. September 1, is much larger than varieties seeded in hotbed.

Tall Green Curled Scotch, seeded in open ground May 20, germinated June 1. July 1, doing nicely, plants vigorous. August 15, very good. September 15, best planted this season.

Lettuce.—Big Boston, seeded in hotbed April 25, came up June 2. June 15, doing splendidly. Seeded in open ground May 20. July 1, very poor. August 15, plants in open ground sending up seed stalks. Plants in old hotbed are excellent.

Other varieties seeded in hotbed and open ground were Morse, Philadelphia, and California Cream Butter. These developed about as did Big Boston.

Parsley.—Early Curled, seeded May 30, up June 15, grew very slowly. August 15, sending up seed stalks. Very poor.

The other variety seeded was Plain or Single. This did no better than the former.

Peas.—Alaska, seeded May 21. June 1, up. Good stand July 1, 5 inches high. July 16, 12 inches high. July 30, in bloom. First picking September 10. This variety did not bear as heavy as some of the others, but was a few days earlier, and the flavor was superior to that of the other varieties seeded.

First and Best, seeded May 20. June 3, up, good stand. July 1, 6 inches high. July 30, in bloom. First picking September 16. This variety gave the heaviest yield of any other variety seeded.

Prolific Early Market, seeded May 21, up June 3, stand good. June 30, 6 inches high. July 16, 12 inches high. First picking September 16.

Premium Gem, seeded May 21. June 5, up, good stand. July 1, 4 inches high. July 16, 6 inches high. First picking October 4.

Potatoes.—Mills Stock, planted May 12. July 1, breaking ground. July 16, good color, but grew very slowly. July 30, average 6 inches high. Dug October 8–9. Less than one-fourth of a crop, 50 per cent small ones.

Garfield, planted May 12. July 1, breaking surface. July 16, good stand. Very slow growth. July 30, 6 inches high. Dug October 7; 25 per cent small ones. One-fourth crop.

Freeman, planted May 13. July 1, very few plants coming up. July 16, stand very poor. July 30, average height 4½ inches. Very few potatoes set.

Kenai Stock (white), planted May 13. July 1, breaking ground. July 16, poor stand. July 30, average height 5 inches. Dug October 7. Almost a failure.

Kenai Stock (red), planted May 13. July 1, coming up. July 16, stand fair. July 30, average height 5 inches. Dug October 6. Failure.

Other varieties of which a few were planted were Early Ohio, Extra Early Ohio, Bovee, Carman No. 3, Extra Early Triumph, and Hamilton Early.

A few were started in boxes placed in the hotbed and then transplanted to the open ground. These gave no better results than those started in the open. They were planted on our warmest ground and produced a few potatoes ranging in size from hazelnuts to walnuts.

Rhubarb.—Planted July 1. This grew well throughout the season. The older roots grew very poorly, due, perhaps, to location.

Ruta-baga.—Purple Top Yellow Swede, seeded May 19. June 13, up, good stand. July 1, second leaves just forming. August 15, growing very slowly, seed stalks forming. September 15, roots the size of teacups and many plants running to seed.

Other varieties seeded were Champion and Yellow. These developed the same as the Purple Top. The same varieties seeded three weeks later produced the same results.

Sage.—Twenty-five per cent of the plants survived the winter. June 15, growing nicely. August 15, in bloom. No seed developed.

Turnips.—Only the White Strap Leaf was seeded. This did not develop normally, grew very slowly, and sent up seed stalks.

GRASSES (THIRD SEASON'S GROWTH).

Meadow foxtail (*Alopecurus pratensis*).—June 1, very good stand, 4 inches tall. June 15, in bloom, some of the stalks 2 feet tall. September 1, seed in dough, but the growth very light. October 1, seed ripe.

Tall meadow oat grass (*Avena elatior*).—June 1, stand good, 6 inches tall. July 1, heading from 2 to 4 feet, very good. September 1, seed in dough and beginning to ripen. This is the best of our tame grasses, judging from its behavior here.

Kentucky bluegrass (*Poa pratensis*).—June 1, very thin stand, 4 inches high. July 1, in full head but light growth, 1 foot high. Sep-

tember 1, seed ripe, but apparently of poor quality. Bluegrass does not do as well here as in warmer regions.

Tall meadow fescue (*Festuca elatior*).—June 1, very poor stand and new growth spindling. July 1, continues poor, plants turning yellow, some heading, 15 inches tall. October 1, seed ripe. Its behavior here does not promise well for its usefulness.

Redtop (*Agrostis vulgaris*).—June 1, good stand, but scarcely any growth. August 15, in bloom, best 2 feet, but a light growth. September 1, seed nearly ripe. Is not promising.

Timothy (*Phleum pratense*).—Stand very thin and but little growth. July 1, 15 inches tall, beginning to head. August 15, in bloom, heads very short, and growth light. September 1, seed just forming. October 1, some seed ripe and some will fail to ripen.

Orchard grass (*Dactylis glomerata*).—June 1, stand very poor, but some of it 6 inches tall. July 1, heading, seed stalks 2 feet. August 15, in bloom. October 1, some seed ripe. This is the third year, and none of the grasses was as vigorous as last year.

White clover is perennial and will spread in door yards and grass plats wherever it gets a start. Red clover winterkilled.

WORK AT KENAI STATION.

Work has been continued at the Kenai Station along the lines followed in former years. Twenty-one acres were under culture the past season, and 3½ acres more were cleared, broken, and fenced during the summer, making a total area of 24½ acres available for culture next year. This last clearing was made in the woods, so as to leave a heavy shelter belt of timber as a protection to the crops against the winds from the inlet. Aside from the testing of many varieties of grain, vegetables, grasses, and forage plants, the details of which are given in Mr. Ross's report submitted herewith, every variety of grain was grown on plats fertilized with superphosphate at the rate of 300 pounds to the acre. The purpose was to ascertain the influence of this fertilizer, first, on the growth of the crop, and, secondly, to ascertain if it would hasten maturity. The results show a very decided increase in growth on the fertilized plats, but there was but little proof that it hastened the development of the grains.

The season was so cold and backward that none of the grains matured. A killing frost occurred August 26, when most of the grain was still in the dough state. It is not surprising that grain should fail to mature at Kenai, since it failed everywhere else in the entire coast region. The grain was cut for hay, and produced a large yield of fine quality. The failure to mature gives emphasis to the surmise expressed in former reports that the region is better adapted to stock raising than to grain growing. Early varieties of barley and oats

can be matured in sheltered positions in favorable years, but our experience at this station is decidedly unfavorable to the idea that the region bordering Cook Inlet is adapted to profitable grain growing. Forage can be grown to an unlimited extent. The grasses and other forage plants have also done well; so there is no doubt about the adaptability of the region for the production of stock feed.

The station now owns 10 head of live stock, 4 of which are milch cows, 3 calves, and 3 work oxen. One of the latter is so old and decrepit that he will not be wintered. The cows have all been reared at Kenai, and are therefore thoroughly accustomed to the conditions, having been fed exclusively on forage produced there. From their milk record, given in Mr. Ross's report, it will be seen that for native cows they are not bad milkers. Bourka, a cow in her prime, yielded 5,437 pounds of milk in two hundred and sixty-eight days without any grain whatever. The other three cows yielded less, but they are all young, and will doubtless do better in coming years.

As soon as funds can be had for the purpose some 8 or 10 head of good dairy cows should be added to this station, so as to enable us to undertake dairy experiments on a small scale. Mr. Ross has made small amounts of butter from the four cows now at the station, but is without adequate utensils. It is hoped to provide a hand separator and other necessary utensils this coming spring.

The stations in the Copper River Valley and at Rampart should have the first consideration until they are so far developed as to be able to practice farming on a scale comparable with that of the average farmer in the States. This development work is very expensive. As noted elsewhere, labor costs $6 a day on the Yukon and $5 a day at the Copper Center Station, so that unless we have a special appropriation for live-stock experiments the funds will not permit of the purchase of dairy cattle for the Kenai Station.

REPORT OF P. H. ROSS, SUPERINTENDENT OF KENAI STATION.

KENAI, ALASKA, *September 19, 1904.*

DEAR SIR: I have the honor to make the following report for the season of 1904:

WEATHER CONDITIONS.

The season opened very favorably. The snow was entirely gone by April 24, and the plowing began May 2. The frost was not entirely out of the ground at that time, but the soil was thawed to a sufficient depth to start the plow. The spring proved very dry, rain not falling in measurable quantities at any time during the month of May. For twenty days of the month a cold southwest wind retarded the growth of crops. During the month of June 0.87 inch of rain

fell, and for nineteen days the wind was in the southwest. Up to August 7 the highest temperature reached was 65° F. In short, it is the driest and coldest growing season, with the earliest severe frost recorded by the station. From the reports of old settlers it is the most unfavorable ever known in the Cook Inlet country. One remarkable feature of the season was the practically total absence of mosquitoes.

CLEARING LAND.

In addition to the care of grain, grasses, and forage crops on the 21 acres already cleared, 3½ acres have been cleared, broken, and fenced. This new clearing is well back in the woods, with a broad belt of timber giving it good protection from the winds of the inlet. It has a southeastern slope which affords good exposure to the sun and good drainage. There is every reason to believe that all crops will do much better on this ground than on the ground already cleared.

FERTILIZER EXPERIMENTS.

Two-thirds of an acre of ground was plowed, and fertilized with superphosphate, sown broadcast at the rate of 300 pounds to the acre. The fertilizer was then harrowed in. This plat was seeded to every variety of grain on hand. A similar plat near by was seeded in the same way, but without fertilizer. The results show that the fertilized soil produces a much more even, uniform, and rank growth, and consequently a heavier yield of grain.

Burt Extra Early oats.—Seeded May 12 in both plats. June 1, just coming up in both plats. June 15, stand good, 3 inches high in both plats. July 1, fertilized, 6 inches high; unfertilized, 4 inches high. July 15, fertilized, 12 inches high; unfertilized, 6 to 10 inches high. August 1, fertilized, uniformly 24 inches high, fully headed; unfertilized, 12 to 24 inches high, 90 per cent headed. August 15, fertilized, 36 inches high, some in bloom and some in milk; unfertilized, 24 to 36 inches high, ranker spots in bloom. September 1, fertilized, 40 inches high, grain in dough, shriveled and watery from frost of August 26; unfertilized, in about the same condition.

Hulless barley.—Seeded May 12 in both plats. June 1, just up with good stand in both plats. June 15, stand heavy, 3 inches high in both plats. July 1, fertilized, 12 inches high; unfertilized, 4 to 8 inches high. July 1, fertilized, 14 inches high, a few heads showing; unfertilized, 4 to 14 inches high, 70 per cent yellow and stunted, no heads. August 1, fertilized, 30 to 36 inches, headed and in bloom; unfertilized, 50 per cent headed and in bloom. August 15, fertilized, average 36 inches high, uniformly in dough; unfertilized, 12 to 40 inches high, rank spots in dough. September 1, fertilized, 40 to 48

inches high, well advanced in dough, grain shriveled by frost; unfertilized, 24 to 40 inches high, rank spots still in dough, injured by frost.

Beardless barley.—Seeded May 12. June 1, just coming up in both plats. June 15, heavy stand, 4 inches high in both plats. July 1, fertilized, 6 to 12 inches high; unfertilized, 4 to 8 inches high. July 15, fertilized, 10 to 14 inches, quite a number of heads showing; unfertilized, 4 to 14 inches, 30 per cent yellow and stunted, a very few heads. August 1, fertilized, 30 to 36 inches high, headed and in bloom; unfertilized, 12 to 36 inches high, 90 per cent headed and in bloom. August 15, fertilized, average 36 inches high, uniformly in dough; unfertilized, 12 to 40 inches high, rank spots in dough. September 1, fertilized, 36 inches high, well advanced in dough, grain shriveled by frost, leaves turning yellow.

Corn-wheat.—Seeded May 12. June 1, just coming up in both plats. June 15, 3 inches high, good stand in both plats. July 1, fertilized, 6 inches high; unfertilized, 4 inches high. July 15, fertilized, 12 inches high, uniform; unfertilized, 6 to 10 inches high, spindling growth. August 1, fertilized, 30 to 40 inches high, 90 per cent headed; unfertilized, 12 to 30 inches high, 50 per cent headed. August 15, fertilized, in milk and small percentage in dough; unfertilized, 24 to 36 inches high, in milk. September 1, failed to fill in both plats.

Common oats.—Seeded May 12. June 1, just coming up in both plats. June 15, heavy stand, 3 inches high in both plats. July 15, fertilized, 6 to 14 inches high; unfertilized, 6 to 10 inches high. August 1, fertilized, a narrow strip running the whole length of the plat at one edge is dark green in color and averages 36 inches in height. The remainder of the plat is about 18 inches high and is of a yellow, unhealthy color; unfertilized, 12 to 36 inches, dark green. August 15, fertilized, headed and partly in bloom; unfertilized, 20 to 36 inches high, none in bloom. September 1, fertilized, 40 to 48 inches high, some in milk and some in dough when killed by frost of August 28; unfertilized, about the same.

Another plat was seeded to barley and part of each plat fertilized with kainit at the rate of 500 pounds to the acre. The fertilizer had no apparent effect on the growth of the grain.

White Hulless barley.—Seeded May 12. June 15, stand good, 3 inches high. July 1, growth spotted, yellow, and unthrifty. July 15, 4 to 14 inches high. August 1, 12 to 36 inches high, rank spots headed and in bloom. August 15, 20 to 30 inches high, rank spots in dough. September 1, further advanced in dough but shriveled by frost.

Beardless barley.—Same results as above.

VALUE OF SHELTER BELTS.

Common oats.—The greater part of the ground under cultivation was seeded to field oats. The benefit of a belt of timber in neutralizing the effect of the inlet winds is very strikingly shown this season. Field A is situated just back of the village, fully exposed to the southwest wind. Field B is protected on all sides by timber. Following are the notes of the growth on each field:

Field A, seeded on May 21. Field B, seeded May 20, 23, and 24. June 15, Field A, stand good, 2½ inches high; Field B, stand good, 3 inches high. July 1, Field A, 4 inches high; Field B, 4 to 6 inches high. July 15, Field A, 6 to 10 inches high; Field B, 6 to 10 inches high. August 1, Field A, 12 to 18 inches high, a few heads; Field B, 24 to 30 inches high, no heads. August 15, Field A, 26 inches high, fully headed; Field B, 36 inches high, beginning to head. September 3, Field A, 30 inches high; Field B, 40 to 48 inches high. Will be cut for hay as soon as weather permits.

WINTER GRAIN.

On August 18 and 19, 1903, the following winter grains were sown: Winter wheat, Yarasloff wheat, Excelsior, Schlansted, and Techitin rye. Only the Winter wheat and Excelsior rye survived the winter. Following are the notes:

Winter wheat.—May 16, 3 inches high, growth spotted. June 1, no growth. June 15, 3 to 18 inches high. July 1, 6 to 36 inches high, some heads appearing. July 15, headed out, 18 to 40 inches high. August 1, 18 to 50 inches high, a small percentage in bloom. August 15, a small percentage in milk, the remainder in bloom. Some in bloom, some in milk, and some in dough when killed by frost of August 26.

Excelsior winter rye.—May 16, 3 inches high. June 15, 12 to 18 inches high, some heads showing. July 1, 40 inches high, fully headed. July 15, 40 to 56 inches high. August 1, 40 to 60 inches high, small percentage in bloom. August 15, partly in dough stage. Killed by frost August 26.

VEGETABLES.

Cabbage.—Large Early York and Early Jersey Wakefield planted in hotbed April 25. Large Late Flat Dutch, Henderson Early Summer, and Improved Stonemason planted in hotbed May 1. The two latter failed to germinate. The Large Late Flat Dutch is too late and will not head this year. Early Jersey Wakefield and Large Early York were transplanted to open ground June 9. The spring being very dry and backward, they did not begin to grow well until

the 1st of August. They are heading at the present time and will probably make fair-sized heads. Many plants were killed by the insect popularly known as the cabbage maggot.

Cauliflower.—Extra Early Paris seeded in hotbed April 25. Transplanted to open ground June 8. All plants killed by cabbage maggot.

Parsley.—Extra Curled seeded in hotbed April 25. Was not removed from hotbed and made a splendid growth 12 inches high.

Onions.—Extra Early Brown Spanish seeded in hotbed April 25. Remained in hotbed, producing onions about three-fourths of an inch in diameter. Onion sets placed in the ground May 13 attained a size of 2 inches in diameter.

Lettuce.—Big Boston and California Butter seeded in hotbed April 25. As the other plants were removed the lettuce was transplanted to their place in the hotbed. Both varieties did very well, forming large, compact heads, crisp and tender.

Celery.—Improved White Plume seeded in hotbed April 25. The plants made but a poor, sickly growth.

Radishes.—Early Scarlet Turnip and French Breakfast seeded in hotbed April 25. Ready for table use May 31.

Kale.—Tall Curled Scotch seeded in hotbed April 25. Transplanted to open ground June 8. Grew well from the first, and at present some plants are 15 inches in height and measure 36 inches from tip to tip of the leaves.

Beans.—Extra Early Challenge, Black Wax, Broad Windsor, Extra Early Red Valentine, Giant Stringless, and Green Pod Valentine were seeded. None of these beans attained a size of over 3 inches in height except the Broad Windsor, which grew to a height of 2 feet, coming into bloom August 1. A few pods had formed by August 26, when growth was stopped by the frost.

Peas.—Alaska and Prolific Early Market seeded in open ground May 13. Came into bloom August 1. Peas large enough for use August 25. Both varieties did equally well as to earliness, with the Alaska bearing somewhat heavier than the Early Market.

Beets.—Extra Early Eclipse Blood Turnip and Crimson Globe seeded in open ground May 13. Both varieties did very poorly, attaining a size of 2 inches in diameter.

Carrots.—Scarlet Horn and Half Long Stump Rooted seeded in open ground May 13. At present both varieties are about 1 inch in diameter and are still growing.

Spinach.—Long Standing seeded in open ground May 14. Ran to seed almost immediately after coming up.

Parsnips.—Early Round seeded in open ground May 14. Will not become large enough for use.

The Rhubarb was large enough for use May 31 and remained tender and juicy until September 1.

Sugar beets.—Elite Kleinwanzleben. Part of the seed was grown in Germany and part in Nebraska, but no difference was apparent in results. Two plats were seeded, one in Field A and one in Field B. Field A, which is exposed to the southwest winds, produced nothing. In Field B the beets attained a size of 2 inches in diameter. Some of the plants are running to seed.

FORAGE CROPS.

Canadian field peas.—Seeded May 20. June 15, stand good, 2 inches high. July 1, 4 to 6 inches high. July 15, 6 to 12 inches high. August 1, vines 30 inches in length. August 15, vines 40 inches in length, in bloom. September 1, vines 4 feet long, no pods formed. Cut for hay September 7.

Rape.—Seeded May 27. June 15, just coming up. July 4, stand good, 1 inch high. July 15, 2½ inches high. August 1, 6 to 12 inches high. August 15, 6 to 18 inches high. Cut September 5. The plat was exposed to southwest winds.

Spring vetch.—Seeded May 27. June 15, just coming up. July 1, stand good, 1 inch high. July 15, 2½ inches high. August 1, 6 inches high, spreading. August 15, 12 inches high. September 1, 24 inches high, a few blossoms. Cut September 7.

Hairy vetch.—Seeded May 27. June 15, just coming up. July 1, stand good, 1 inch high. July 15, 2 inches high. August 1, 4 to 6 inches high, spreading. August 15, no growth. September 1, 12 to 20 inches high. Cut September 7.

Alfalfa.—Seeded May 27. July 1, 1 inch high, true leaves developing. July 15, 1½ inches high. August 1, 4 inches high. August 15, 4 to 9 inches high. September 1, 4 to 12 inches high.

GRASSES SEEDED IN 1902.

Agrostis vulgaris.—June 1, 3 inches high. June 15, 4 inches high. July 1, 6 inches high. July 15, 18 inches high, headed out. Cut for hay July 23.

Dactylis glomerata.—June 1, 2 inches high. June 15, 3 to 6 inches high. July 1, 6 inches high, looks unthrifty. July 15, 24 inches high, headed out. Cut for hay July 23.

Alopecurus pratensis.—June 1, 3 to 6 inches high, beginning to head. June 15, 12 to 16 inches high. July 1, 30 inches high. July 15, 30 inches high. Cut for hay July 23.

Phleum pratense.—June 1, 4 inches high. June 15, 6 inches high. July 1, 8 inches high. July 15, 12 to 18 inches high, heading out. Cut for hay July 23.

Bromus inermis.—June 1, 5 inches high. June 15, 8 inches high. July 1, 12 inches high. Cut for hay July 23.

Festuca elatior.—June 1, 3 inches high. June 15, 5 inches high. July 1, 6 to 12 inches high. July 15, 24 to 30 inches high. Cut for hay July 23.

GRASSES SEEDED IN 1903.

Of the grasses seeded in 1903, the following were winterkilled: *Avena elatior* and *Lolium perenne*. The notes on the remainder are as follows:

Bromus inermis.—June 1, 3 inches high. June 15, 6 to 12 inches high. July 1, heavy uniform growth, 15 inches high. July 15, 20 to 30 inches high.

Alopecurus pratensis.—June 1, 2 inches high. June 15, 12 to 16 inches high. July 1, 20 inches high. July 15, 24 inches high, in bloom.

Phleum pratense.—June 1, 2 inches high. June 15, 4 inches high. July 1, 6 inches high. July 15, 12 inches high, heading out.

Festuca elatior.—June 1, 3 inches high. June 15, 3 to 6 inches high. July 1, 12 to 18 inches high. July 15, 24 inches high, heading out.

Agrostis vulgaris.—June 1, 2 inches high. June 15, 4 inches high. July 1, 6 inches high. July 15, 8 inches high.

White and Alsike clovers made a slow, unhealthy growth, reaching a height of 12 inches. Both will mature some seed.

All the above grasses, but not the clovers, were cut for hay July 23.

One-half of each of the grass plats seeded in 1902 and 1903 were sown with land plaster May 27. No effect whatever was noted in any of the plats.

GRASSES SEEDED IN 1904.

Festuca pratensis.—Seeded May 27. July 1, heavy stand, 1 inch high. July 15, 3 inches high. August 1, no growth. August 15, 4 to 6 inches high. September 1, 6 inches high, no seed formed.

Poa pratensis.—July 1, 1 inch high. July 15, 3 inches high. Made no further growth during the season.

Lolium perenne.—July 1, 2 inches high. July 15, 3 inches high. August 1, 4 inches high. August 15, 6 inches high. September 1, no further growth in height, but spreading out, forming a compact sod.

Phleum pratense.—July 1, one-half inch high. July 15, 2 inches high. August 1, 4 inches high, looking fine. August 15, 6 inches high. September 1, 6 to 9 inches high, a few heads appearing.

Avena elatior.—July 1, 1½ inches high. July 15, 4 inches high. August 1, 8 inches high. August 15, 12 inches high. September 1, 12 to 18 inches high, a few heads.

Festuca elatior.—July 1, 1 inch high. July 15, 3 inches high. August 1, no growth. August 15, 4 inches high. September 1, no growth.

Dactylis glomerata.—July 1, 1 inch high, heavy stand. July 15, 3 inches high. August 15, 6 inches high. September 1, 12 inches high, spreading and forming a good sod.

EXPERIMENTS WITH POTATOES.

A midsummer frost July 6, and another August 26, made it impossible to draw any conclusions from the potato experiments.

Early Rose and Early Burbank were planted May 10. They began to appear above ground by July 1. The frost of July 6 destroyed the tops, but they rallied and made a rapid growth until August 26, when the vines were again frozen to the ground without having come into bloom. No growth has taken place since.

Planted potato eyes of the following varieties: May 13, Hamilton Early, Extra Early Ohio, Extra Early Triumph, and Carman No. 3. Two rows of each variety were planted, and one row of each fertilized with kainit. These plants were killed by frost July 6, and never recovered.

Planted Bovee and Extra Early Ohio May 24. Two rows of each variety were planted, one row of each being fertilized with kainit. The Bovee never recovered from the frost of July 6. The Extra Early Ohio recovered and made a rank vine growth, but was killed by the frost of August 26 without having come into bloom. No noticeable difference between fertilized and unfertilized rows.

LIVE STOCK.

The cattle now owned by the station are: Three work oxen, 4 milch cows, and 3 calves. They were fed exclusively on native feed during the winter, and came through in excellent condition. Two of the cows were in milk during the winter months, their record being given below.

The calves were removed from the cows shortly after birth and taught to drink milk. They were fed on whole milk until two weeks old, and then gradually brought to a skim-milk diet. They were weaned at four months. The calves remained vigorous and healthy at all times, and are in excellent condition at present.

As during other seasons the oxen were fed nothing but native feed while working, and remained in fair condition. The station has so much land cleared now that an ox team is too slow to do the work properly. It is hoped to have a team of horses next year.

MILK RECORD.

In comparing these records with records made by cows in the States it must be borne in mind that the cows owned by this station have not been heretofore properly fed, bred, or milked to develop dairy characteristics. They are native cattle, closely inbred, accustomed to be milked while on grass in the summer and forced to shift for themselves for the larger part during the winter, under which conditions of course the milk flow ceases. Cows reared under such conditions will not give the best results even with the best of feed. Definite conclusions can be drawn from the results only when the station will be able to experiment with cattle of a distinct breed.

Bourka.—Dropped calf December 7, 1903. Milking period in days, 268; total yield, 5,437.5 pounds; average daily yield, 20.29 pounds. Besides being a persistent milker this cow gives milk that appears to be very rich in butter fat. She is the best cow in the herd.

Snowball.—Dropped calf January 10. Milking period in days, 230; total yield, 1,818 pounds; average daily yield, 7.81 pounds. This cow dropped her calf when but 18 months old. Her average daily yield for July was twice as great as that of January.

Liska.—Dropped calf April 10. Milking period in days, 143; total yield, 2,675.5 pounds; average daily yield, 18.64 pounds.

Marka.—Dropped calf May 7. Milking period in days, 115; total yield, 2,043.5 pounds; average daily yield, 17.76 pounds.

The record given for each of the cows ends September 1. All are still in milk.

Besides feeding the calves there was enough milk to supply the local demand.

The butter made was first-class in every respect. We have nothing but the crudest of utensils to use in butter making. One of the needs of the station is a complete dairy outfit.

Respectfully submitted.

P. H. Ross,
Superintendent Kenai Experiment Station.

Prof. C. C. Georgeson,
Special Agent in Charge of Alaska Investigations.

COPPER CENTER STATION.

Work has been pushed successfully at this station throughout the open season. Sixteen acres were under culture the past season and 21 acres more have been cleared, making a total of 37 acres at this writing. Only 6 acres of the new clearing have been broken, however, but it is hoped to break 10 acres, or possibly more, in the spring

before seeding. Mr. Neal has in addition built a cottage, which he now occupies with his family, and also a barn with shed attached, though the roof is not completed at this writing. A good team of horses has been purchased to replace the worn-out team of pack horses, and the stock of implements has been added to. There is still needed a blacksmithing outfit, a fanning mill, a hand seed drill, and some hand tools, which it is hoped to supply this winter.

Mr. Neal reports that he found it difficult to get good men to work, even at $5 a day, which has been the wages paid for white labor. The cost of living is $4 a day for board and lodging.

TRAIL WORK.

Mr. Neal spent over three months on the trail—namely, from January 9 to April 19—hauling our equipments of feed, fertilizers, and seed grain, and a few implements from Valdez to Copper Center. This work is exceedingly hard on both man and beast, and nobody can stand it for many years in succession. Mr. Neal could not handle this freight alone, and still we had no money to hire help. The wages of a man on the trail is $125 a month, but the seed grain, fertilizers, and other things had to get in on the snow, so Mr. Neal exchanged labor with John McCrary, a settler in the Copper River Valley, who needed supplies hauled over, and an arrangement was made by which Mr. McCrary helped Mr. Neal on the trail every day during the three months, and as compensation we hauled in his provisions, weighing 1,433 pounds, the price for hauling being fixed at 15 cents a pound. This would not pay Mr. McCrary's wages for the whole period, so Mr. Neal arranged with the road-house keeper at Ernestine to haul in 1,600 pounds of provisions for him at 10 cents a pound, Ernestine being a little more than half way to Copper Center. By this means the station equipment was landed without having to pay out anything for labor.

As stated in the last report, half the equipment sent in a year ago was stranded at Teikhel, the snow leaving the ground when that place was reached. This equipment remained stored until last winter, when it was very kindly taken in by the military forces at Fort Liscum on the application of the Secretary of Agriculture. It was a small matter to the military department, as they had the men and an abundance of horses. We could not have taken it in with the funds at our disposal. We had more freight to transport from Valdez than could be handled by one man or one horse, and Mr. Neal could not handle two horses alone. By adding a ton and a half we had the services of a man to lead one horse and to help with the loading and unloading at relay stations and in the thousand emergencies where help is needed on the trail.

EXPERIMENTS.

We had upward of 150 plats at the station, large and small, in which were tested many varieties of barley, oats, wheat, vegetables, and grasses. Tests were made with and without fertilizers and on newly cleared ground compared with ground cultivated last year (Pl. IX, fig. 1). It was again confirmed, as in former years, that new land is less productive than land which has been under culture. The experiments also prove that the soil responds to fertilizers. The details of these tests are given in Mr. Neal's report, submitted herewith.

The bulk of the grain failed to mature. Sixty-day oats and Finnish Black oats matured in part, and also a little each of Manchuria, Lapland, and Manshury barley, but none of the wheats matured. A killing frost occurred August 17, and this, of course, destroyed much of the experimental value of our work. The frosted grain has been cut for hay, and the relative yield of hay of each variety of grain, on fertilized and unfertilized plats, is given in Mr. Neal's report. Although the bulk of the grain was killed, the results were better in the interior than on the coast. In the interior we matured some grain, while in the coast region none whatever matured, and in many places the grain was scarcely formed in the heads.

It is our plan to continue to clear land at the Copper Center Station to the extent our funds will permit, until we shall have well on toward a hundred acres in cultivation. The coming year it is also planned to seed down large plats to those grasses which give promise of doing well there in order to afford pasture for the stock. It is also time to introduce a few cows at the station, so that we can note how they thrive under the conditions there presented.

In former reports it has been explained that the land in the Copper River Valley lies in broad terraces or benches. Our clearing, so far, has been on the second bench, counting the river bottom the first bench. Mr. Neal observed that the vegetation seemed to suffer less from frost on the upper benches than on the bench where the clearing is located, and we will therefore clear some land on each bench in order to see if the higher ground is more immune from early frosts, as seems quite possible.

REPORT OF J. W. NEAL, SUPERINTENDENT OF COPPER CENTER STATION.

COPPER CENTER, ALASKA,
October 5, 1904.

DEAR SIR: I herewith submit my third annual report from the Copper Center Experiment Station, disclosing the season's work for 1904.

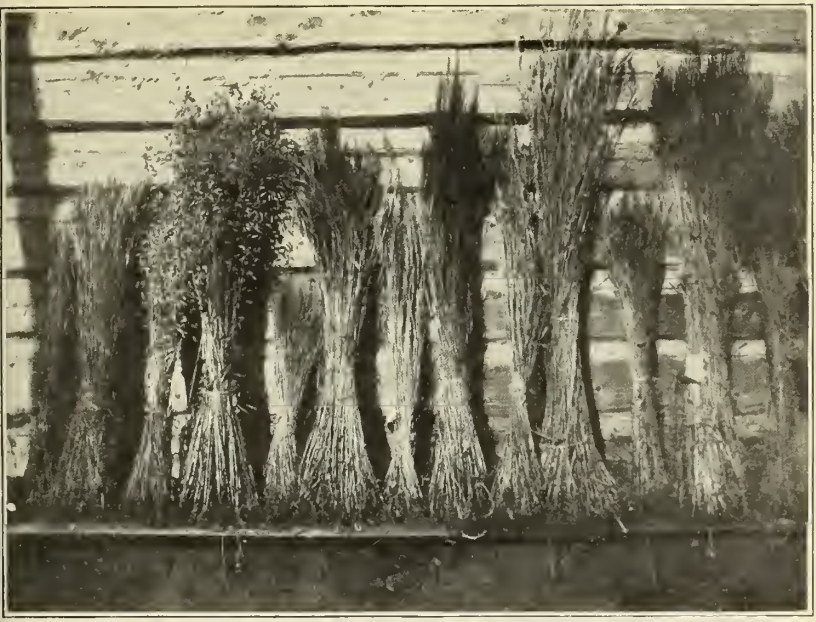

FIG. 1.—COPPER CENTER STATION—EFFECT OF FERTILIZERS, 1904.

Samples of emmer, oats, barley, rye, and wheat, each grown on 12 square feet of fertilized (on right) and unfertilized (on left) plats.

FIG. 2.—COPPER CENTER STATION—SISOLSK BARLEY, 1904.

After closing my last report I learned that our funds were too limited to attempt to finish the station cottage for winter quarters, and at your suggestion I secured a cabin at Copper Center from Mr. Blix, which with a little renovating made quite comfortable winter quarters for myself and family.

During the early winter I spent my time getting out timbers for a barn and cache. And by exchanging some work with a neighbor, I got the cache up and barn well started.

As it was now nearing the winter freighting season, and our team being again wintered in Valdez, I left Copper Center on January 9, traveling by dog team. I arrived at Valdez on the 17th, being out nine days in deep snow and bitter cold. I found our supplies about all packed ready for transportation. It required some three days, however, to fit up sleds and accustom the team to the snow trail. Finding I could not handle the stuff alone, and there being no available funds with which to hire help, by authority, I made an agreement with John McCrary to drive one horse for us at $125 per month, boarding himself, he to be remunerated in freight hauled with the station team at 10 cents a pound to Ernestine, and 15 cents a pound to Copper Center. This arrangement resulted in McCrary working three months ($375), we hauling for him to Ernestine 1,600 pounds ($160) and to Copper Center 1,433 pounds ($214.95), making a total of $374.95 for his services.

We hauled our first load out of Valdez January 21, landing everything at the station April 19, the snow then being gone from all exposed places. We experienced two severe storms in the vicinity of Thomsons Pass, and our stock suffered some injury. The ground being yet frozen, I cut and hauled some saw logs and worked on the cottage until April 28. The frost was then sufficiently out of the ground, and I began plowing April 30. I seeded some 3 acres to wheat, barley, and oats. Plowing and seeding continued until May 14, when our horse feed gave out, and I turned the team outside. We then had about 14 acres seeded and 2 acres of sod broken. Hand seeding continued until May 20.

We cleared for the season about 21 acres, 6 of which have been broken. The early frost has hindered the fall breaking.

IMPROVEMENTS.

Since the last report we have built a 12 by 16 foot cache and seed room, made the cottage habitable for winter quarters, and added a 12-foot shed roof for summer kitchen; also a log barn 20 by 24 feet, 13 feet high, with a 14-foot shed on two sides. The sheds are covered with bark and the main part as yet with canvas, for want of roof material.

HELP AT THE STATION.

For the last twelve months we have had no regular help, but simply hired men when we needed them most, paying white men $5 per day and the natives $3 per day, as my instructions were to pay no more. Owing to the high prices here and board at the road house being $3 per day or $4 with lodging, I found it difficult to get good men at these wages for the short time we hire them. My wife offered to board the men at $2 a day, not charging them for Sundays and rainy days. This enabled me to get good men at the set wages. She boarded the native help at $1 per day, working days only, which was less than actual cost of the food consumed.

WEATHER CONDITIONS.

Unlike last year, the spring opened early and at first promised a favorable season. The seeds germinated quickly and grew very rapidly for a time. In fact, the growth was rapid throughout the season, but there being little sunshine and much damp weather, the crops had little tendency to mature. The temperature fell to the frost line every month in the season. During May we had rain thirteen days and not a single clear day. In June we had rain twenty-four days and not a single clear day. In July we had rain twenty-three days and five clear days. In August we had rain nineteen days and six clear days, with seven days frost, the lowest 24° F. In September we had rain twelve days and sixteen clear days, with nineteen days frost, the lowest 6° F.

As a result of these weather conditions, the grain was slow to head and very slow in filling. The straw remained green in many instances all fall and froze while yet green. Wheat and barley were frosted, but several varieties of oats ripened as good seed apparently as last year.

FIELD NOTES.

Barley.—Manshury, seeded April 30 on old and new ground, coming up in fifteen days; stand thin. This was home-grown seed, flailed out and poorly cleaned, which caused thin seeding. June 1, 3 inches high and looking good. June 15, 5 to 7 inches high and stooling well. July 1, the best 12 inches high. July 15, 24 to 30 inches high and heading. August 1, 42 inches high, in full head, and grain half formed. August 15, straw turning fast and grain in the dough. Some ash spots more advanced. August 17, the temperature fell to 26° F., frosting nearly all of the barley. For some time thereafter the weather kept damp and cloudy, keeping the straw green. A few high spots matured good heads. The crop

was cut for hay September 2, saving the few matured head for seed. The old ground produced fully 90 per cent more feed stuff than the new.

A 2-acre plat, new ground of fall breaking, was seeded with imported seed May 14. This came up in nine days. Stand good. June 1, 2 to 3 inches high. Good color. Ash spots very marked. June 15, 4 to 8 inches high, rank growth, and stooling well on the ash spots. July 1, 12 inches high on the ash spots and little growth elsewhere. July 15, best 30 inches high and just beginning to head. August 1, on the ash spots in full head, 4 feet tall, and very thick on the ground. The grain about one-third formed. Other portions headed 12 to 20 inches high. August 15, passing into the dough and straw ripening fast on the ash spots. This, too, was frosted August 17, and cut for hay on August 24.

Still a third plat was hand drilled May 17 from home-grown seed, half of this plat being fertilized with fish guano at the rate of 500 pounds per acre, drilled with the grain in one application. This seeding came up in ten days. Stand a little thin. June 1, 2 inches high. Color good. June 15, 6 inches high and stooling. The fertilized portion now showed a ranker growth. July 1, best 12 inches high; the unfertilized 8 inches high. July 15, 24 inches high and signs of heading; unfertilized portion 12 to 16 inches high. August 1, 52 inches tall. Thick and even on the ground. The grain about one-third formed. The unfertilized portion stood 36 to 40 inches tall and much thinner, as it stooled very little. The heads were much younger. August 15, straw turning, grain about full size. Unfertilized portion more backward. August 17, the grain was frosted and later the whole crop turned into hay.

Lapland, seeded April 30 on old and new ground, coming up in fourteen days. Stand good. This was home-grown seed, flailed out, but comparatively easily cleaned. June 1, 1 to 3 inches high and looking good. June 15, 4 to 8 inches high, the best being on the old ground. It was stooling some and looking good. July 1, 12 to 18 inches high and signs of heading. July 15, 24 to 30 inches high and heads just out. August 1, 36 to 40 inches tall, headed out, and grain one-third formed. August 15, straw quite yellow and grain in the dough. The furthest advanced of all varieties. August 17, the grain was injured by frost. Some heads were past danger. The crop was cradled, bound, and stored, to be tested for seed.

A plat was drilled May 17 from home-grown seed, one-half of the plat being fertilized with fish guano as the above. This was coming up in 10 days. Stand fair. June 1, 2 inches high. June 15, 6 inches high, thrifty and good color; the unfertilized had made 4 inches growth and had a pale color. July 1, 7 to 13 inches high. July 15, the best 30 inches high and heading; unfertilized, 12 inches

high and not heading. August 1, best 40 inches tall, stooled quite thickly, grain one-third formed; unfertilized, 28 inches tall, headed, but a little backward and much thinner on the ground. August 15, grain in the dough and straw quite yellow; the unfertilized not quite so far advanced. August 17, the grain was frosted and shrunk badly. The heads were large and well filled.

Manchuria, seeded in hand drills May 6, one-half being fertilized with fish guano as above varieties, coming up in nine days. Stand good. June 1, 3 to 5 inches high, showing a very marked difference where the fertilizer was used. June 15, best 10 inches high and stooling well; the unfertilized was 5 to 6 inches high and stooling very little. July 1, 16 inches high; unfertilized, 10 inches high. July 15, 32 inches high and heading; unfertilized, 12 inches high and beginning to head. August 1, 42 inches tall, very thick and even, grain very full; unfertilized, 26 inches tall, thin, and grain about the same stage. August 15, straw golden yellow, grain in the stiff dough; unfertilized not quite so far advanced. August 17, frost injured, causing the grain to shrink. The crop was cut and flailed out to be tested for seed.

Another plat was seeded on new ground May 14, coming up in eight days. Stand good. June 1, 2 to 3 inches high, color good. June 15, the most part stood 4 inches high; on all ash spots it stood 7 to 8 inches high and stooling well. July 1, 14 inches high on the ash spots; other portions making little growth. July 15, best 30 inches high and begun heading. August 1, 40 inches high on the ash spots, thick on the ground, and in full head; heads large and filling well. August 15, grain passing to the dough and straw turning; ash spots more advanced. August 17, the grain was frosted and the crop cut for hay August 24.

Another plat of Manchuria barley was seeded on old ground May 14, coming up in eight days. Stand good. June 1, 2 inches high and looking fine. June 15, 4 to 5 inches high. July 1, 8 inches high and quite even. July 15, 18 inches high and signs of heading. August 1, average 36 inches high and grain forming. August 15, grain nearly full. August 17, grain frosted and cut for hay, yielding a good hay crop.

No. 9133 barley, seeded April 30, coming up in thirteen days. Stand good. This was new ground. June 1, 2 to 5 inches high, looking yellow and sickly, except on the ash spots; a little touched by spring frosts. June 15, the main plat made little growth during the last fifteen days and looks bad; on ash spots the growth was rank, standing 10 inches high and stooling well. July 1, 15 inches high on the ash spots. July 15, best 24 inches high and heading. August 1, 24 to 36 inches high on the ash spots and the grain about two-thirds formed. August 15, straw quite yellow on the ash spots,

and the grain in the stiff dough; other portions quite green and short. August 17, grain frosted and shrunk badly. Cut for hay September 1.

Another plat was seeded May 14 on new ground, coming up in ten days; stand good. June 1, 2 to 3 inches high; color good. June 15, 6 to 7 inches high on ash spots, and stooling; other portions 4 inches high. July 1, 12 inches high on ash spots; other portions making little growth. July 15, best 20 inches high and thick on the ground; signs of heading. August 1, heads well out some days, standing 40 inches high. August 15, straw turning and grain in the dough. August 17, grain frosted and cut for hay a few days later. The ash spots yielded a heavy crop, but the other portions not worth cutting.

Still another plat was seeded May 17 in hand drills, one-half being fertilized with fish guano as above varieties, coming up in eleven days; stand medium. June 1, 1 inch high. June 15, 6 inches high and stooling well on the fertilized portion; about half as much growth on unfertilized portions. July 1, best 9 inches high. July 15, best 22 inches high and signs of heading. August 1, 36 to 40 inches tall and headed; unfertilized, 24 inches tall and just heading. August 15, straw turning and grain in the dough; unfertilized portions more backward. August 17, grain frosted and the crop cut for hay.

Royal, seeded May 17 in hand drills, one-half being fertilized with fish guano as above varieties, coming up in ten days; stand good. June 1, 1 inch high. June 15, 6 inches high and stooling well on fertilized portions, other portions making less growth. July 1, best 12 inches high. July 15, 24 inches high and heading on fertilized portions; unfertilized, 14 inches high. August 1, best 40 inches tall, in full head, and grain about one-third formed; unfertilized portions 30 inches tall, heads younger, and grain much thinner on the ground. August 15, straw quite yellow and grain in the dough; unfertilized several days later. August 17, grain frosted and cut for hay later.

A Norway variety, offered by Burke, editor of Valdez Prospector, seeded May 14 in hand drills, one-half being fertilized with fish guano as above varieties, coming up in ten days; stand good. June 1, 1 inch high. June 15, 6 inches high and stooling well; unfertilized portions not quite so good. July 1, best 12 inches high; unfertilized 8 inches high. July 15, best 24 inches high and signs of heading; unfertilized 15 inches high. August 1, 46 inches high on fertilized portion, in full head, and grain forming; unfertilized, 30 inches tall and much thinner. August 15, straw turning. Grain of both plats in the dough. August 17, grain frosted and crop cut for hay.

Black Hulless, seeded May 17 in hand drills, one-half being fertilized with fish guano as above varieties, coming up in twelve days;

stand poor. June 1, well up. June 15, 6 inches high, good color, and stooling. July 1, fertilized, 11 inches growth; unfertilized, 9 inches growth. July 15, 18 to 24 inches high and signs of heading; unfertilized, 12 to 18 inches high. August 1, best 42 inches tall, well stooled, and headed; later stools not all headed; unfertilized, 24 to 30 inches tall, thinner, and many heads not full out. August 15, straw turning, grain about full size; unfertilized, some days later. August 17, grain frosted and cut for hay later.

Finnish, seeded May 18 in hand drills, one-half being fertilized with fish guano as above varieties, coming up in eleven days; stand thin; home-grown seed flailed out and poorly cleaned. June 1, just up. June 15, 6 inches high and stooling well. July 1, 9 inches high on fertilized portion; 7 inches high on that unfertilized. July 15, best 22 inches high and signs of heading; unfertilized, 16 inches high. August 1, 44 inches tall and heading. August 15, straw turning; grain nearly full size. August 17, grain frosted and cut for hay later.

Sisolsk, seeded May 16 from home-grown seed in hand drills, half the plat fertilized with fish guano as above varieties, coming up in fourteen days. June 1, well up, stand thin. June 15, 5 inches high and stooling. July 1, 10 inches high on that fertilized, 6 inches high on that unfertilized. July 15, best 18 inches high and signs of heading, unfertilized 12 inches high. August 1, 44 inches tall and pretty well headed out; unfertilized 24 inches tall and much thinner on the ground. August 17, grain frosted and afterwards cut for hay. (Pl. IX, fig. 2.)

Trooper six-rowed, seeded May 16 from home-grown seed and one-half of the plat fertilized with fish guano as above varieties. Coming up in fourteen days. June 1, well up, stand thin. Only a small percentage of this seed germinated. June 15, best 5 inches high and stooling; fertilized portion slightly advanced. July 1, 12 inches high on the fertilized ground and 7 inches high on the unfertilized. July 15, best 20 inches high and signs of heading; 14 inches high on the unfertilized. August 1, 42 inches tall and very well stooled on the fertilized ground, about all headed out; 32 inches tall and very poorly stooled on the unfertilized. August 15, straw very green, grain about two-thirds formed; the unfertilized was a little more backward. August 17, grain frosted, and cut for hay later.

This is the first season since the advent of the white man to the Copper Valley that barley has failed to mature. Even this year the several varieties made an abundance of fodder, which was cut and cured for hay. When the killing frost came, August 17, Manchuria, Lapland, and Manshury were the farthest advanced and all promised a handsome yield, ripening in the order named, all producing long heads, well filled.

FIG. 1.—RIPE SIXTY-DAY OATS HARVESTED FOR SEED AT COPPER CENTER STATION, 1904.

FIG. 2.—HEAVY GROWTH OF FINNISH BLACK OATS, 1904, AT COPPER CENTER.

Oats.—Sixty-day, seeded April 30 on old and new ground from home-grown seed. Coming up in fourteen days; stand excellent. June 1, 3 to 4 inches high, looking fine. June 15, 7 to 9 inches high on the old ground and stooling well. July 1, 12 inches high, very even, and looking good on the old ground; on the new ground very poor. July 15, 18 to 20 inches high and heading. August 1, in full head, averaging 30 inches high, and grain half formed. August 15, straw ripening and grain in the dough. September 1, grain ripened and cut for seed. The straw was yet quite full of sap, and a few green heads frosted, but fully 90 per cent matured thoroughly, making an average crop. The old ground produced fully 50 per cent more than the new. (Pl. X, fig. 1.)

A small plat was seeded in hand drills May 6 from imported seed and half of the plat fertilized with fish guano at the rate of 500 pounds per acre, being drilled in with the seed in one application. Coming up in ten days. June 1, 3 to 4 inches high, stand good. June 15, 6 to 8 inches high on the fertilized portion, stooling well, and looking fine; 5 to 6 inches high on the unfertilized portion. July 1, 12 inches high where fertilized, and 8 inches high where no guano was used. July 15, 16 to 18 inches high and signs of heading on the fertilized ground; on the unfertilized, 12 inches high. August 1, the best 30 inches tall, very thick and even over the ground, grain filling; 20 inches high and quite thick on the unfertilized portion. August 15, straw turning, grain filled and in the milk. September 1, grain in the dough, and straw about the proper ripeness for hay. Some heads frosted, but I feel safe in estimating fully 90 per cent of well-matured grain.

Swedish Select, seeded April 30 on new ground. Coming up in thirteen days. June 1, 2 to 5 inches high, ash spots well defined, stand good. June 15, 10 inches high and stooling well on all ash spots, other portions 4 inches high and stooling very little. July 1, best 15 inches high, other portions 6 to 10 inches high. July 15, best 18 to 20 inches high and heading. August 1, 36 inches high on the ash spots and grain half filled. This was fully 75 per cent better than other portions of the plat. August 15, straw turning, grain in the dough. September 1, quite ripe enough for hay, and being very uneven was cut for hay. It was well filled and some grains hard.

A larger plat was seeded on old ground May 7 and 9 with the seed drill. Coming up in ten days, stand excellent. June 1, 3 inches high, dark green, and thrifty. June 15, 7 inches high. July 1, 12 inches high, looking good. July 15, 18 inches high and signs of heading. Ash spots from previous year slightly marked. August 1, in full head, 30 inches high, well stooled, and thick on the ground, heads beginning to fill. August 15, straw turning some days, grain in the soft dough. August 17, frost did not seem to damage it.

September 1, ripening very slowly. September 15, grain fully ripe and cut for seed, straw yet very sappy. This variety was well filled and made a good average crop.

Finnish Black, seeded May 9, in field plat with seed drill on old ground. Coming up in ten days, stand excellent. June 1, 3 inches high. June 15, 8 inches high, stooling and looking fine. July 1, best 12 inches high and signs of heading, looking fine. August 1, headed and average height about 40 inches; much of the crop stood 4 feet high and some portions fully 5 feet; heads beginning to fill. August 15, straw turning some days, grain about in the dough. This variety seemed to withstand the heavy frosts through August, and September 1 the grain was getting quite hard. Heads large and well filled. September 15 the grain was fully ripe, but the straw yet quite full of sap. The crop cut and saved for seed. (Pl. X, fig. 2.)

Another plat was seeded May 17 in hand drills, one-half of the plat being fertilized with fish guano as the above plats. Coming up in nine days, stand good. June 1, 2¼ inches high, slightly better where guano was used. June 15, 7 inches high and stooling well on fertilized portion; unfertilized 5 inches high and a little yellow. July 1, best 11 inches high; unfertilized 7 inches high. July 15, best 20 inches high and a few heads out; unfertilized 10 inches high. August 1, best 44 inches high, very thick and even on the ground, grain filling; unfertilized, best 28 inches high and much thinner. August 15, straw turning and grain nearly filled. September 1, grain quite hard and straw nearly ripe. September 15, grain and straw quite ripe and cut for seed.

Duppaur, seeded May 16 in hand drills and half the plat fertilized as other plats. Coming up in twelve days, stand fair. June 1, 3 to 4 inches high, the part fertilized showing slightly better. June 15, 7 to 8 inches high, stooling good, and looking fine on the fertilized part; 5 to 7 inches high on the unfertilized portion, stooling less, but a good color. July 1, 12 inches high where fertilized; unfertilized 9 inches high. July 15, best 18 inches high and signs of heading; unfertilized 14 inches high and same stage. August 1, average height 36 inches where fertilized, well stooled, and grain one-third filled; unfertilized 28 inches high, much thinner, and a little advanced. August 15, straw turning and grain about full. September 1, the top grains matured, but all the lower grains, or probably 90 per cent, frosted. The straw yet very green, heads large. The crop cut for hay.

Burt Extra Early, seed from Minnesota Station originally. This planting, grown at Kenai Station season of 1900, seeded May 6 thickly in hand drills, half the plat being fertilized with fish guano as the other plats. Coming up in twelve days, stand very thin, seed poor. June 1, 3 inches high. June 15, 6 to 7 inches high. July 1,

14 inches high on the fertilized portion; the unfertilized 11 inches high, all about heading. July 15, best 24 inches high; the unfertilized 20 inches high, all pretty well headed out. August 1, 36 inches high and well stooled where fertilized; the unfertilized a little shorter and stooled much less, grain just beginning to fill. August 15, grain about half filled, unfertilized slightly advanced. The late August frosts injured the grain. September 1, straw yet very green and grain all frosted. Heads were large and well filled.

Another plat was seeded and fertilized May 6 in the same manner, from Sitka-grown seed, coming up in eleven days: stand very good. June 1, 4 to 5 inches high; a marked difference where fertilized. June 15, best 9 inches high, stooling and looking fine; the unfertilized 6 inches high. July 1, 18 inches high, and begun heading on fertilized portion; unfertilized 8 inches high. July 15, 24 inches high on the fertilized; other portions 13 inches high, all pretty well headed out. August 1, best 36 inches tall, thick, and even on the ground, grain one-third filled; unfertilized 24 inches high, much thinner and grain not so far advanced. August 15, straw turning and grain in the milk. September 1, the upper grains had matured, but the lower part of the heads were yet green and frosted in August. I think about 60 per cent of the grain matured. On this plat, as with many others, the fertilizer increased the growth about 75 per cent.

No. 2800, a Russian variety, seeded May 6 and fertilized as other plats, coming up in twelve days; stand poor. June 1, 3 inches high. June 15, 8 inches high, stooling well and looking fine where fertilized; unfertilized 6 inches high and stooling very little, color good. July 1, best 12 inches high; unfertilized 8 inches high. July 15, 18 to 20 inches high where fertilized, and begun heading; other portions 12 inches high. August 1, average height 36 inches, thick and even over the fertilized portion; unfertilized 24 inches high and quite thin on the ground. August 15, best 42 inches tall, straw very green, grain about three-fourths filled; unfertilized a little advanced; all the heads were very large. September 1, the straw yet very green and the grain frosted. The straw was a little frozen and hard to cure for hay.

Common oats, from Seattle markets and used on the trail, seeded April 30 on old and new ground, coming up in thirteen days; stand good. June 1, 3 inches high, looking well. June 15, 6 to 8 inches high, and stooling well. July 1, 10 to 12 inches high. July 15, 15 to 18 inches high, about ready to head. August 1, 24 to 30 inches high, and headed. August 15, straw turning, grain in the milk. September 1, grain about matured, straw a little green. The August frosts did not seem to affect this plat. The crop was cut to feed as sheaf oats. They were well filled, heavy, and made first-class feed.

Wheat.—Roumanian spring, seeded April 30 on old and new ground, coming up in thirteen days; stand good. July 1, 4½ inches high, looking good. June 15, 6 to 10 inches high, and stooling some on the old ground. July 1, average 12 inches high. July 15, 18 inches high, heading. August 1, best 30 inches high, a little thinner on the ground; heads small, beginning to fill. August 15, straw turning, heads well filled. Grain frosted August 17. Cut for hay September 1. The old ground produced about 40 per cent more feed stuff than the new.

Another plat was seeded May 5, in hand drills, and half the plat fertilized with fish guano at the rate of 500 pounds per acre, being drilled in with the seed in one application; coming up in eleven days, stand good. June 1, 3 to 4 inches high. June 15, 9 inches high, stooling well and looking fine where fertilized; unfertilized 6 inches high and stooling very little. July 1, best 15 inches high; unfertilized, 8 inches high. July 15, 24 inches high on fertilized portion, and just begun heading; unfertilized 12 inches high, not heading. August 1, average 42 inches high, and quite thick growth on fertilized ground; just beginning to fill; unfertilized 30 inches high, thin on the ground, grain a little more advanced. August 15, straw turning, grain two-thirds filled, heads large. Grain frosted August 17. Straw quite green and sappy yet. September 1, crop cut for hay.

Another plat was seeded May 7 on old ground with seed drill, coming up in eleven days; stand very good. June 1, 3 inches high. June 15, 7 to 8 inches high and stooling some, looking fine. July 1, best 13 inches high. July 15, 18 to 20 inches high, about heading. August 1, in full head 24 to 40 inches high, grain just beginning to fill. August 15, straw turning, grain three-fourths filled. Grain frosted August 17. Straw quite green when cut September 1 for hay. This plat produced a good average crop of hay.

Dufferin spring wheat, seeded May 4, in hand drills and half the plat fertilized with fish guano at the rate of 500 pounds per acre in one application, coming up in eleven days; stand good. June 1, 4 to 5 inches high. June 15, 11 inches high and stooling well where guano was used; unfertilized, 8 inches high, stooling very little. July 1, best 22 inches high; unfertilized, 17 inches high. July 15, 30 to 36 inches high where fertilizer was used; unfertilized, 18 to 22 inches high; both heading. August 1, 48 inches tall, in full head and grain filling on fertilized portion; unfertilized, 36 to 42 inches tall, grain about the same. August 15, straw turning, grain three-fourths filled. Grain frosted August 17. Straw quite green yet, September 1, when cut for hay. This plat produced a very heavy crop of straw.

Glyndon spring wheat, seeded and fertilized as above, May 1, coming up in twelve days; stand good. June 1, 2 to 4 inches high; a marked difference where guano was used. June 15, 7 to 8 inches high and stooling well where guano was used; unfertilized, 4 to 5 inches high, not stooling, looking bad compared to that fertilized. July 1, best 12 to 16 inches high; unfertilized, 8 to 11 inches high. July 15, 22 inches high where fertilizer was used; unfertilized, 18 inches high; both about ready to head. August 1, 40 inches high, headed and thick on the ground where fertilized; unfertilized, 24 to 28 inches high, quite thin on the ground, grain not quite so far advanced. August 15, straw turning, grain two-thirds filled, heads large. Grain frosted August 17. Straw yet quite green, September 1, when cut for hay. This plat made a heavy crop of straw.

Harold spring wheat, seeded May 4 and fertilized as above plats, coming up in eleven days; stand good. June 1, 3 to 5 inches high; fertilized portion much ranker growth and better color. June 15, best 11 inches high and stooling well; unfertilized, 6 to 8 inches growth, stooling very little. July 1, best 8 inches high; unfertilized, 12 to 18 inches high. July 15, best 24 inches high; unfertilized, 18 to 20 inches high; both about headed out. August 1, 38 to 40 inches high and very thick on the ground fertilized, grain just beginning to fill. August 15, straw turning, grain nearly filled, heads good size. Grain frosted August 17; straw very sappy yet. September 12, crop cut for hay.

Phmper spring wheat, seeded May 5 and fertilized as above plats, coming up in twelve days; stand good. June 1, 4 to 5 inches high. July 15, 9 to 10 inches high and stooling well where fertilized; 7 to 8 inches high and stooling a little on the unfertilized portion; looking better than other unfertilized plats. July 1, best 17 inches high; unfertilized, 12 inches high. July 15, best 24 to 30 inches high and begun heading; unfertilized, 18 to 20 inches high, heading. August 1, best 44 inches tall and thick on the ground; unfertilized, 33 inches high, a little thin on the ground. On both the grain was just beginning to fill. August 15, straw turning, grain half filled. Grain frosted August 17; straw green yet. September 1, cut for hay. This plat produced a heavy crop of straw.

Ladoga spring wheat, seeded May 5 and fertilized as above plats, coming up in twelve days; stand good. June 1, 4 inches high, looking well. June 15, 8 to 10 inches high and stooling well where fertilized; that unfertilized was looking well, but a noticeable difference. July 1, best, 15 inches high; unfertilized, 10 to 12 inches high. July 15, best, 22 inches high; unfertilized, 20 inches high, about heading. August 1, 42 inches high and thick on the ground fertilized,

grain just beginning to fill; unfertilized a little thinner and some shorter straw, but less difference than on any other plat tested with the fertilizer. August 15, straw turning, grain two-thirds filled, heads large. Grain frosted August 17. Straw yet green September 1. This made a very heavy crop of straw; cut for hay September 1.

Russian (Orenburg) spring wheat, seeded May 15, and fertilized as above plats, coming up in eleven days; stand good. June 1, 3 to 5 inches high, looking much better where fertilized. June 15, 7 to 9 inches high, stooling well and looking fine where guano was used; unfertilized, 5 to 7 inches high and stooling very little. July 1, best, 16 inches high; unfertilized, 8 inches high. July 15, 22 inches high, about heading; unfertilized, 12 to 14 inches high. August 1, best, 40 inches high and thick on the ground; unfertilized, 24 inches high, quite thin on the ground, grain just beginning to fill. August 15, straw turning, grain two-thirds filled. Grain frosted August 17. September 1, straw yet green. Heavy crop of straw cut for hay.

Romanow, first importation, seed from Sitka, crop 1900, seeded May 5 in hand drills, a very small portion being fertilized with guano and a small portion with ashes. The ashes made no visible difference in the growth or advancement; probably not enough was used; coming up in eleven days. June 1, 3 to 4 inches high, all looking good, seeded very thin, seemingly every grain came. June 15, 6 to 7 inches high, stooling some and looking well; where guano was used, 7 to 8 inches high, stooling well. July 1, 10 inches high on the unfertilized, 14 inches high where guano was used. July 15, 15 inches high where no fertilizer was used, 24 inches high where guano was used; both about heading. August 1, 24 inches tall without fertilizer, 38 to 40 inches tall where guano was used; both full headed and grain just beginning to fill. August 15, straw beginning to turn, grain about two-thirds filled. Grain frosted August 17. No visible difference in the degree of ripeness; heads were much larger and grain well stooled where guano was used. The straw was cut for hay September 1, yet quite full of sap.

Another plat was seeded in hand drills May 14 where brush had been burned the year previous. As requested, I gave the variety special attention. This came up in ten days. June 1, 3 inches high, looking good. June 15, 6 to 9 inches high and stooling well. This was also seeded very thin, but stooled out to be quite thick on the ground. July 1, 12 to 14 inches high, looking fine. July 15, 18 inches high, about ready to head. August 1, 36 inches high, well headed out; some smut appeared. August 15, straw turning fast, heads large and well filled, grain about in the dough. Grain frosted August 17. Straw did not seem to ripen much after this frost. The crop cut for hay later. This variety was the farthest advanced of all the spring wheats when the killing frost came.

Pererodka spring wheat, seeded May 5 and fertilized as above plats, coming up in eleven days; stand good. June 1, 4 to 5 inches high. June 15, 7 to 9 inches high, stooling well and looking fine where fertilized; unfertilized, 6 to 7 inches high and looking fairly well. July 1, best, 15 inches high; unfertilized, 12 inches high. July 15, best, 28 inches high, about heading; unfertilized, 20 inches high, heading. August 1, 42 inches tall and thick on the fertilized ground, grain just beginning to fill; unfertilized, 36 inches high, some thinner on the ground, grain slightly advanced. August 15, straw turning, grain about two-thirds filled; unfertilized, a little advanced. Grain frosted August 17, heads large. September 1, straw yet quite green. The plat made a heavy crop of straw.

Kubanka spring wheat, seeded May 6, and half the plat fertilized as above variety, coming up in twelve days; stand good. June 1, 4 to 5 inches high; a little better where guano was used. June 15, 7 to 9 inches high, stooling well and looking fine where fertilized; other portions 5 to 7 inches high, stooling very little. July 1, best 14 inches high; unfertilized, 10 to 11 inches high. July 15, best 28 inches high, heading; unfertilized, 18 inches high, just beginning to head. August 1, 46 inches high and thick and even where fertilized, grain begining to fill; unfertilized, 38 inches tall, thinner on the ground, grain about the same. August 15, straw turning, grain about two-thirds filled; unfertilized, a little advanced. Grain frosted, August 17. September 1, straw sufficiently matured to make good hay.

Russian spring wheat, No. 2955, seeded May 6, and half the plat fertilized as above varieties, coming up in twelve days; stand very thin, seed evidently poor. June 1, 3 to 4 inches high, looking good. June 15, 5 to 8 inches high; no apparent difference from unfertilized. July 1, 12 inches high where fertilizer was used; unfertilized, 8 inches growth. July 15, best 20 inches high, signs of heading; unfertilized, 16 inches high. August 1, best 36 inches high, quite thick on the ground, heading; unfertilized, 26 inches high, some thinner, heading. August 15, grain half filled, straw quite green, some heads blighted. Grain frosted August 17. September 1, straw yet green, cut for hay.

Karkhov winter, seeded with seed drill August 11, 1903, coming up in ten days. Stand good, but the growth was not sufficient by winter to stand the extreme cold. Fully 90 per cent was winterkilled. What lived through was very weak and showed no signs of growth until May 5. The snow was off the plat April 20. June 1, 4 inches high, stooling some, and looking good in spots. June 15, 8 to 10 inches growth, jointing. July 1, 12 to 15 inches high, sign of heading. July 15, 18 to 20 inches high and heading. August 1, blooming. August 15, grain nearly filled, some heads well filled,

straw yet very green. Grain frosted August 17. Straw had not fully matured when cold weather came. This grain was seeded too late. This season our winter wheat was seeded about thirty days earlier, and as the season closes the ground is a carpet of green.

Rye.—Excelsior, seeded August 11, 1903, in hand drills, coming up in ten days; stand poor. Only a small percentage stood the winter and started very slow in spring. June 1, stooled some and jointing, 10 inches high. June 15, 18 inches high and heading. July 1, 36 inches high, headed. July 15, 40 inches high, passing from the bloom. August 1, grain half formed, some heads blighted. August 15, the few good heads left nearly filled. Grain frosted August 17. The straw did not mature fully.

Russian winter, No. 2961, seeded as above August 11, coming up in ten days; very little stood the winter. The little that lived through came very slowly in the spring. June 1, 6 to 8 inches high, stooled some, and jointing. June 15, 16 inches high. July 1, 24 to 30 inches high, heading. July 15, 30 to 40 inches high, not bloomed yet. August 1, just beginning to fill. August 15, grain nearly filled, some heads blighted. Grain frosted August 17. Straw still green and did not fully mature.

Winter, No. 5903, seeded August 11, coming up in ten days, stand poor and much of it winterkilled. June 1, 8 inches high, stooled some, and jointing. June 15, 16 inches high. July 1, 24 to 36 inches high, heading. July 15, 40 to 48 inches tall, not bloomed. August 1, beginning to fill. August 15, grain about half filled, some heads blighted. Grain frosted August 17. Straw did not fully mature until cold weather.

Schlansted winter, seeded August 11, coming up in ten days. Only a small percentage came, and all was winterkilled.

Like the winter wheat, I am convinced that the rye was seeded too late to get well enough started to stand the cold winter. The winter rye this season was seeded a month earlier than last year. At the close of this season it shows a rich carpet of green.

Russian Spelt No. 2789, seeded May 6 in hand drills, and half the plat fertilized with the guano at the rate of 500 pounds per acre, coming up in twelve days. Only a few seeds came. June 1, 4 to 5 inches high. June 15, 7 to 8 inches high; no apparent difference from unfertilized. July 1, 12 inches high; slightly better where fertilized. July 15, 15 inches high. August 1, 28 inches high; heading. August 15, 36 inches high; grain just beginning to form. Grain frosted August 17, straw did not mature. Cut green about September 15 for hay, and cured with difficulty.

Yaraslof spring Emmer, seeded May 6 and fertilized as other plats, coming up in twelve days; stand good. June 1, 3 to 5 inches high; doing much better where fertilized. June 15, 7 to 9 inches high,

stooling well, and looking fine where fertilized; 5 to 7 inches high on other portions. July 1, best 12 to 14 inches high; unfertilized, 9 to 10 inches high. July 15, best 20 to 22 inches high, an occasional head appearing; unfertilized, 12 to 14 inches high. August 1, 42 inches high, thick and even on fertilized ground, headed, but young; unfertilized, 22 inches high, much thinner on the ground, headed about the same. August 15, straw beginning to turn, grain about half filled. Grain frosted August 17. Straw kept green all fall. Cut green for hay.

Uba spring Emmer, seeded May 6, and half the plat fertilized as the other varieties, coming up in twelve days; stand good. June 1, 3 to 5 inches high, all looking good; some better where fertilized. June 15, 8 to 9 inches high, well stooled, and looking fine where guano was used; unfertilized, 6 to 8 inches high, looking well. July 1, best 13 inches high; unfertilized, 9 to 11 inches high. July 15, 18 to 20 inches high on the fertilized ground, no signs of heading; other portions 14 to 18 inches high. August 1, best 36 inches high, very thick and even over the ground, heads just out; unfertilized, 28 to 32 inches high, not so thick on the ground, heads out the same. August 15, grain two-thirds filled. Grain frosted August 17. Straw kept green all fall. Cured for hay with some difficulty.

Buckwheat.—Silver Hull, seeded May 18, in hand drills and half the plat fertilized with guano as other plats, coming up in fourteen days; stand fair. June 1, coming up. June 15, 2 inches high, third leaf set. July 1, 4 to 5 inches high; much ranker where guano was used. July 15, 10 to 12 inches high, bloom setting. August 1, 30 inches high, well stooled, and covered with blossoms; unfertilized, about half as good. August 15, frost, somewhat injured. Frost August 17, killed all the buckwheat.

Finnish, a few plants came volunteer where it was grown last season. These scattering plants made a good growth and bloomed by July 1. The August frosts killed every plant.

GRAIN HAY.

The following table gives the amount of hay grown per acre, this season on second-year ground, with and without fertilizing. The plats tested were 30 feet square to each variety. One-half of each plat was fertilized with fish guano at the rate of 500 pounds per acre. The crop, when cured sufficiently for storing, was carefully weighed and figured, deducting 25 per cent to make sure of final shrinkage. The tract where these experiments were carried on is light soil, and proved to be very poor. Unfertilized ground the same age in other parts of the station produced equally as much as many of these fertilized plats.

Yield of grain hay on second-year ground with and without fertilizers.

Variety.	Unfertilized.	Fertilized.
	Pounds.	*Pounds.*
Romanow spring wheat	1,186	4,237
Pererodka spring wheat	1,356	2,966
Russian (Orenburg) spring wheat	847	2,373
Kubanka spring wheat	1,186	4,068
Dufferin spring wheat	1,271	5,085
Ladoga spring wheat	1,779	3,813
Harold spring wheat	847	2,343
Plumper spring wheat	1,059	3,135
Glyndon spring wheat	1,356	4,915
Romanow spring wheat	1,610	2,373
Lapland barley	1,101	2,966
Manchuria barley	1,525	3,305
Manshury barley	1,271	4,746
Finnish barley No. 6175	1,271	3,973
Burt Extra Early oats	932	3,262
Sixty-day oats	1,831	3,204
Duppaur oats	1,907	3,814
Finnish Black oats	1,525	4,237
No. 2800 oats	763	3,357
Excelsior winter rye	847	3,390
Uba spring Emmer	1,221	3,678
Yaraslof spring Emmer	1,101	4,152

GRASSES AND FORAGE CROPS.

Timothy of the 1903 seeding had made a good heavy sod. June 1, it made good pasture. July 1, heading. When matured it stood 3 feet high and reminded us of an eastern meadow. The crop was light. Seed matured.

The same, seeded May 6, 1904, and half the plat fertilized with guano at the rate of 500 pounds per acre, coming up in ten days. June 1, drills showing a little green. June 15, 1½ inches growth and set thick. July 1, 5 inches growth. July 15, 7 inches growth. August 1, heading. September 1, stems 24 inches high. Unfertilized portion about half the growth.

Redtop of 1903 seeding did well this year. June 1, afforded some grazing. July 1, 18 inches high, heading. Seed about mature August 15. The full growth was 24 inches and quite thick.

Brome grass of 1903 seeding was well set and made excellent pasture by the middle of May. June 1, 6 inches growth. June 15, 12 to 18 inches growth. July 1, best 30 inches high, thick on the ground. August 1, undergrowth thick, 20 inches high; heads 36 to 40 inches high.

Same, seeded May 6, 1904. Half the plat fertilized as the timothy, coming up in twelve days. June 1, 1 inch growth. June 15, 3 to 4 inches growth, set thick. July 1, 6 to 7 inches growth. August 1, heading, looking fine. September 1, 18 inches high where fertilized; 12 inches high elsewhere.

Bluegrass, 1903 seeding. June 1, showing quite green, a little thin. June 15, 5 to 7 inches growth, much thicker. July 1, stems

18 inches high, heading. July 15, 24 inches high. August 15, seed about mature.

Orchard grass, 1903 seeding. June 1, showed quite green. June 15, 3 to 5 inches growth. August 15, ground well covered. A good sod.

Same, seeded May 6, 1904. Half the plat fertilized with guano, coming up in eleven days. June 1, drills showed a little green. June 15, 2 inches growth, set thick. July 1, 5 inches growth. July 15, 8 inches growth. August 1, looking fine. September 1, 10 to 12 inches high where guano was used; elsewhere about half the growth.

Meadow foxtail, 1903 seeding. June 1, showed quite green. June 15, 5 to 7 inches high, some stems thrown out, and heading. July 1, 20 inches high, headed. July 15, 30 inches high. August 15, seed quite mature.

Meadow fescue, 1903 seeding. June 1, 3 inches growth. June 15, 8 to 12 inches growth. July 1, best 40 inches high, heading. July 15, 30 to 40 inches high. August 1, in bloom, best 48 inches tall. No seed matured.

Same, seeded May 6, 1904. Half the plat fertilized with fish guano as other varieties. June 1, not up. June 15, 2 inches growth. July 1, 4 inches growth. July 15, 5 inches growth. September 1, a good sod and well stooled. A few stems thrown out. No noticeable difference from unfertilized.

Red clover, 1903 seeding. A few stalks lived through the winter. June 15, 2 to 3 inches growth, with a number of leaves and several stems. July 1, looking good. July 15, 6 inches high. August 1, a few plants in bloom. Several plants blossomed late in August. August frosts injured the plants badly.

Same, seeded May 19, 1904. Half the plat fertilized with guano. Coming up in twelve days. June 15, 3 leaves set. July 1, looking fair. September 1, 4 to 6 inches high and quite spread out, but very small for a season's growth. The growth was much better where guano was used.

Aslike clover, 1903 seeding. June 15, a few plants appeared small, but several leaves. July 15, some plants 4 to 5 inches high. August 15, little more growth. Did poorly for the season.

Same, seeded May 19, 1904, coming up in fourteen days. June 15, 3 leaves set. July 1, making slow growth. July 15, little growth. Unfertilized plants did the best, but neither made much showing.

White clover, seeded May 19, 1904, coming up in twelve days. June 15, 3 leaves set. July 15, showing quite green. September 1, a good stand, but plants very small. The season was evidently too cold for all the clovers.

THE GARDEN.

The season this year proved very unfavorable for many hardy vegetables which were noted as a success last year. The precipitation for the growing season was about 6 inches, but the weather kept cool and cloudy so much that the garden stuff came on very slowly. The temperature reached 87° F. only once during the entire season. During the month of June the warmest day was 76° F.

Cabbage and cauliflower were started in boxes indoors in March. Good plants set in the open ground June 1. These made good-sized plants by fall and some heads forming, but not to say fit for table use, except as greens. The cauliflower formed tiny heads the size of walnuts.

Turnips, radishes, parsnips, carrots, lettuce, spinach, cress, mustard, and kale all did about the same as last year. Peas were almost a total failure. Onions from seed made very small bulbs.

Early curled parsley, seeded May 16. Only 4 plants came up. These made nice plants.

Ruta-bagas, started in a warm frame early in May and transplanted to the garden in June, made a rapid growth. These were set 12 inches apart each way. Late in July the tops covered the ground. September 15, some were pulled, the tops being over 2 feet long. The roots measured 16 inches around, weighing 3 pounds. Those seeded in the open ground fell considerably short of this, yet they made a fair size for table use.

Beets, Golden Tankard, made roots 7 to 10 inches around. Crimson Globe, 6 to 9 inches around.

Rhubarb from seed last year made good-sized stalks this year, and indicates that it is well adapted to this section.

Broad Windsor beans, nine varieties were received and planted with care, after danger of spring frosts. Nearly every seed came. Each variety made good plants, blooming about July 15, pods setting August 15. Frost August 5 injured some. A heavy frost August 17 killed what had escaped.

Potatoes, Extra Early Triumph, Extra Early Ohio, Hamilton Early, and Carman No. 3 were received through the mail in fair condition. The seed was divided, half being planted immediately, the remainder being kept in warm moist soil about a hot frame for some days before planting. The latter came up first and as a result made a little better crop. Giving these varieties special attention, I covered them with canvas when there was any danger of frost. The eyes planted were very small and naturally the tops did not get very large. All made a fair growth, however, and looked healthy. No variety blossomed. The tops froze late in August under canvas. September 12 the crop was dug and put away for seed. Although immature the tubers were from the size of marbles to guinea eggs.

I had 25 pounds of Burbank potatoes shipped in from Valdez on the late snow, costing $11 at the station. The smaller ones were planted whole and the large ones cut in half. These were planted May 16. The first hill appeared June 1. All up June 15 and growing nicely. July 15, tops rank and large. Some in bloom. These potatoes were planted close to the edge of a bluff and escaped the early frosts. The later frosts froze the vines. The yield was small, yet four hills made two good, hearty messes for six people. The potatoes were small, but quite large enough for table use.

THE FLOWER GARDEN.

The flower garden, although much neglected, was a pleasure and a scene of beauty.

Pansies did well, blooming from August 17 until winter set in.

Nemophila, mixed, made a profusion of flowers through August and September; excellent for borders.

Poppies, both the California and mixed, gave a profusion of flowers for a long period.

Larkspur did well.

Candytuft, white and purple, was very showy through August and September.

Phlox blossomed in September, a bright red.

Collinsia did well.

Mignonette blossomed in August.

Crimson flax blossomed in August.

RECOMMENDATIONS.

I recommend as especially needed at this station a seed drill with fertilizer attachment, 1 fanning mill, 1 complete blacksmithing outfit, 1 grain cradle with extra blade, and 1 16-inch breaking plow with extra share, the John Deere brush breaker preferred, with standing cutter and gauge wheel.

The question of forage has been one of the perplexing problems at this station, but I now feel safe in recommending the starting of a small dairy herd. Reverend Clevenger, the missionary, wintered a milch cow at Copper Center last winter on native hay with very little grain. The cow gave a good flow of milk all winter and raised a fine heifer calf. We paid Mr. Clevenger $10 a month all winter and to September 1 for 1 quart of milk a day. Mr. Blix paid him $20 a month for 2 quarts a day during this time. Mr. Clevenger said they had plenty of milk for their own use and made their own butter.

Respectfully submitted.

J. W. NEAL,
Superintendent Copper Center Experiment Station.

Prof. C. C. GEORGESON,
Special Agent in Charge of Alaska Investigations.

RAMPART STATION.

The reservation at Rampart was made in 1900, and Mr. Isaac Jones was left in charge. He resigned in the fall of 1901. Since that time no improvements have been made at the station except to cultivate the patch of ground cleared by Mr. Jones. The work at the other stations had now progressed so far that it was deemed wise to spend less elsewhere and more at Rampart. With a view of developing this station to the extent our funds will permit, an equipment has been purchased and sent up, and Mr. Fred E. Rader was detached from the Sitka Station, where he had been assistant since the spring of 1900, and placed in charge of the Rampart Station.

Mr. Rader left Sitka July 7 for his new field of work and arrived at Rampart July 29. When he reached Dawson he found that no boat would go down the river for a number of days, and so rather than waste his time waiting he and two or three other persons bound down the river purchased a small scow, in which they drifted down.

Mr. Rader's report has not come to hand at this writing, but I gather the following data from his letters: The grain which was seeded by Mr. J. W. Duncan on the half acre of cleared land was very promising. The barley matured fully and was cut August 16. The ground from which it was cut was spaded up at once and seeded to several varieties of winter wheat and rye. The oats also matured a little later, but the wheat was caught by frost during the first days of September, before it was ripe, though he thinks some of it may grow.

Here, then, we have the somewhat remarkable phenomenon that barley and oats have matured this season in latitude 65° 30′ N., while at the Copper Center Station, in latitude 62° N., these same varieties were killed. The oats saved—the Sixty-day, and it was partly injured—is earlier than any variety grown at Rampart. In the coast region to the southernmost limit of Alaska, in latitude 55° N., no grain matured. It would be erroneous to infer that grain will do better in latitude 65° N. than in regions farther south; but it must nevertheless be noted that grain has matured at the Rampart Station every year from 1901 to 1904, both inclusive. (Pl. XI, fig. 1.)

Mr. Rader hired a couple of men at $6 a day each and began clearing at once. By September 1 he had cleared 2½ acres of new ground. He also built an addition 12 by 14 feet to an old cabin on the reservation, and he and his wife will live there until a better house can be provided. The implements purchased for the station left Seattle about July 15 and arrived safely at Rampart early in September, and seed grain for spring use, shipped from Sitka in July, had also arrived. We have as yet no horses or live stock of any kind at this station, but

FIG. 1.—FENCE BUILT AT RAMPART TO KEEP THE RABBITS FROM THE GRAIN.

FIG. 2.—VIEW OF PORTION OF THE NURSERY, SITKA STATION.

Mr. Rader succeeded in hiring a team at $15 a day to use in breaking the newly cleared ground. Everything is thus in readiness, and next year we shall have at least 3 acres on which to make further tests. The clearing will be extended next year, but it is evident that with labor at $6 a day and team hire at $15 a day we shall be compelled to make haste slowly.

REPORT OF S. A. CALDWELL ON COOPERATIVE EXPERIMENTS AT WOOD ISLAND.

WOOD ISLAND, KADIAK, ALASKA,
September 20, 1904.

DEAR SIR: I herewith submit the report of the agricultural work and experiments for this present year. The planting and caring for the crops were done by Rev. C. P. Coe until the 1st of August. At this writing I shall be unable to give final, definite results in many cases. Because of unfavorable weather, the results are far below that of former seasons. There has not been a day that the thermometer has reached 70° F. All the stable manure made on the place was used, besides other fertilizers.

FIELD CROPS.

Barley.—Five varieties of barley were sown April 18—Giant Beardless, Silver King, Home Grown, White Hulless, and Twentieth Century. Made thin stands and have grown to the height of 2 feet, with short, thick heads. The head is long and heavy. There is but little difference in the above varieties, which were sown on sandy land. The Silver King takes the lead. All will mature.

Oats.—Several plats of land were sown to oats, with good results. The stand was good and grew to the height of 4½ feet, with heads 6 to 9 inches long, well filled, but will not mature. Had the weather been more favorable the crop would have been large. The following varieties were sown: Salzer, Prolific, Big 4 (home grown). The Big 4 gave the best results.

Rye.—Spring home-grown Marvel White. Sown April 18. The straw is 4 feet in height, but the heads are empty. Will be cut for hay.

Winter rye on poor sandy land made a slight stand of 2 feet, with short, empty heads.

Lupine.—Stands 18 inches in height, very scattering. Sown on sand field which is very poor. Some of the heads will mature.

Spurry, *cheat*, and *sand vetch* are equally a failure on the poor sand-field. I found one spot of sand vetch which measured 4 feet from the crown. It is in bloom at this writing, but will not mature seed.

GRASSES.

Timothy.—A small plat of timothy stands 3½ feet high, with long, full heads. Will yield a heavy crop of hay.

Clover.—Mammoth red was sown on sand field April 26. Very little can be seen as a result.

A special mixture of grass seed harrowed in on flat, sandy land with small results.

Phalaris (grass seed).—Sown on marsh next to lake. Result, nothing.

VEGETABLES.

Potatoes.—Potatoes planted April 15 and 16 and on May 7, on sandy land, and compared with other years, are a failure. Some of those planted in April were just breaking ground on June 25, the spring weather was so cold.

Ruta-bagas.—Ruta-bagas were planted in old soil, well manured, but the yield will be small. Some of the largest measure 5 inches in diameter.

Onions.—Onions planted both from sets and seed show small results.

Lettuce.—Many varieties of lettuce were sown on March 26 and May 6. Has not done as well as in former years. We have a number of good heads at this writing.

Peas.—Peas have yielded a very small crop. The varieties sown were Horsford and Prolific.

Salsify.—Salsify sown May 5. Results very small.

Cress.—Cress has been planted in several places, but with small results.

Radishes.—Radishes grew well this year, being planted at various times during the season. Varieties as follows: White, Black Spanish, Chinese Rose. All did well; some of them measured 3 inches through and 1 foot long. Some of the Chinese radishes are 4 inches in diameter, but short. These will become larger if the weather holds favorable.

Turnips.—Turnips are a failure. Very little of the seed germinated, and those that did produced very small roots.

Kale.—Kale planted in garden in old soil well manured has done fairly well.

Cabbage.—Cabbage plants set June 15 have large, broad leaves, but will not head.

Beets.—Beets have not done well this year.

Carrots.—Carrots sowed in drills March 26, May 5. Many of the seeds did not germinate. The others are small. Some of the largest would measure three-fourths of an inch in diameter and 4 inches long.

FLOWERS AND TREES.

We have had the usual success with flowers. Poppies and pansies grew to a large size.

Raspberry and currant bushes planted May 2 are looking well.

Two apple trees—an Astrachan and a June Red—show a slight growth.

LIVE STOCK.

Notwithstanding the lack of proper facilities for taking care of stock in the winter, the animals came through without loss. The pastures being fenced, kept them from the cliffs.

The cows have done as well as usual. Three of the five are giving milk. For the month of July we received 2,800 pounds of milk, which is fully as large as during any month of the year. Increase: Three calves.

But little profit was received from the Angora goats this year. Early in the spring their fleece became loose, and a large part of the mohair was lost. However, they did better than last year relative to increase, since we have an addition of four to the flock.

Relative to poultry, the hens and chickens have done well, supplying the home with eggs, and a large increase in chickens.

The duck house having been moved early in the spring, the ducks have not laid eggs, and thus we have had no increase with them. We hope they may do better another year.

The flock of geese, proving to be all ganders, were slaughtered for the table.

S. A. Caldwell,
Acting Superintendent Kadiak Baptist Orphanage.

Prof. C. C. Georgeson,
Special Agent in Charge of Alaska Investigations.

REPORTS FROM SEED DISTRIBUTION.

Only a few reports of the results of the seed distributed in cooperation with the Bureau of Plant Industry have been received at this writing, and they are for the most part reports of failure, or partial failure, caused by the cold, wet summer. Grains of all kinds were almost total failures everywhere. Potatoes have ranged from failure to a fourth of a crop. It has been too cold for cabbages, cauliflower, and onions. Carrots, lettuce, radishes, and turnips are the only crops which have been generally satisfactory, and even these have been partial failures in many places where they generally do well.

I submit also a few of the belated reports for 1903, which have a general interest.

I would call attention to the reports of J. F. Karshner's farm, on Baker Creek, a tributary of the lower Tanana. One of these is by Mr. A. H. Monroe, of Rampart, and refers to the season of 1903, and the other is a report for the present season by Mr. Karshner himself. Mr. Karshner has located a homestead near certain hot springs in the valley of Baker Creek. He has found that a considerable portion of his claim is a natural hotbed, the source of the heat being presumably the same as that which keeps the springs hot. The possibilities of these unique conditions have not been fully tested, but aside from hardy vegetables he has so far succeeded in growing Lima beans, wax beans, squash, and cucumbers very successfully. A photograph of the Lima beans, which unfortunately is not clear enough to reproduce here, shows that they made a splendid growth and climbed to the top of tall poles. Mr. Monroe states that he found turnips and ruta-bagas in the ground where they grew, not frozen, although the thermometer registered 62° F. below zero at the time. All Alaska gardeners will watch Mr. Karshner's operations with interest.

I beg also to call attention to the letter from Rev. John W. Chapman, of Anvik, as regards the gardens by natives and whites at that place.

T. H. Friedler, Gravina, Alaska.—I have received, from time to time, seeds from you, and I suppose you expect me to report my success in crops.

I have one-half acre under cultivation. This (1903) was the second year. The first year I did not expect to raise much, and raised less. This year I tried some manure experiments. I tried about all the hardy and some half-hardy plants—cucumbers, beans, etc. On unmanured land everything without exception was a complete failure. One patch on which I put lime burned from clam shells, at the rate of 1 bushel to 3 square rods, did not show any improvement at all. I think the lime is slow in acting on account of not being burned enough. I am not a limekiln man; I do not know how to best burn this lime. I built a pile of logs and put the shells on top, and then more logs and more shells, and then set it on fire. But the shells packed together and did not get hot enough inside the pile.

Hen manure improves the land some, but not near as much as I expected. I had one patch on which I put the manure from 100 hens; five months' gathering on 10 rods. This manure was mixed with dry muck, and was in the henhouse until used, and had no cutworms. Radishes, turnips, and cabbage did fairly well. The rest of the things were a failure. But everything did better than on unmanured ground.

Wood ashes put on at the rate of 1 bushel to 2 square rods did better by far than either lime or hen manure. I had only 6 square rods of this, but grew more turnips on it than on about 35 square rods outside this plat that was seeded to turnips. I noticed that the leaves of the turnips on the land manured with ashes were yellow, and where the hen manure was they were dark green and more stocky, but the roots on the soil fertilized with ashes were three times as large. I had some 8 inches in diameter. Am sorry that I did not try more of a variety of plants on ashes. Besides the turnips, I had one hill of cucumbers, and they were fine. On hen-manured soil cucumber vines were only 6 to 8 inches long, with no fruit at all.

In the soil fertilized with ashes I also planted some soy beans I got from a friend in Michigan, but they came here too late. I planted them some time in the latter part of July. I do not know the exact date. I never expected anything to come of them. They were in a package from New York, marked "Early Soja Beans." Well, they grew 2½ feet high, but did not ripen seed; were frosted October 2; but they did so much better than I expected them to do in this climate that I will try them again. The cutworms got hold of the beans and a row of parsnips, both of which were good. Early Red Valentine beans ripened seed.

For a long time I did not know what was eating the plants; thought maybe it was the birds, and would sneak out in the evening with a shotgun, but never got a shot. One evening late I noticed the worms and tried to catch them, but there were so many I did not make any headway, and noticing a few very prosperous toads there I spent an afternoon and caught all the toads I could find, about 60, and dumped them on the ground where the worms were. They fixed the cutworms in a hurry, but it was too late as far as the crop was concerned.

I sowed some winter wheat last fall, about 2 square rods, fertilized with ashes (very little), and hen manure this spring. It made a good stand and did not winterkill. It got about 3½ to 4 feet high, and was ripe about August 10 to 15. Was a very good crop, and I think we can grow grain here.

A few scattering oats and barley grains that were in the sacks used to pack manure in came up and looked very good.

I intend to try a sack each of potash and phosphate next year, also more lime.

My ground is about one-fourth of a mile from the beach, and seaweed is too far to pack. This ground is muck or peat. It is something new to me in the shape of soil. It seems to be composed altogether of rotten moss or of other vegetable matter. It is covered with from 1 to 4 inches of moss, and has quite a growth of grass on it; no timber except here and there a scrubby black pine. This muck is from 8 inches to 1½ feet deep, underlaid with a gravel formation. It is full of bog holes and quite wet, but on being spaded it becomes perfectly dry without drainage. Subduing this soil is not what it is cracked up to be with spade and hoe. The sod is tough and it rots very slowly. A breaking plow and disk harrow are what it wants.

J. S. Scatter, Juneau.—I do not think it is best to report on vegetables this season (1904), for everything is almost a failure. We raised lettuce, radishes, a few carrots and cauliflower, and about a third of a crop of potatoes; no cabbages.

I hope you know of something that will kill the cabbage maggot; they ate the crops as soon as we had a few dry days. I tried everything—potash, nitrate of soda—but did not seem to do any good. There must be something that will destroy them. We have another insect that destroys the young plants in the hotbeds in the spring.

Christian Krogh, Juneau.—I received the seeds, for which I am very thankful, and I will give you the full account of every variety grown during 1904.

Lettuce, radishes, peas, ruta-bagas, and carrots all did well. Beets and turnips went to seed. Onions and parsnips hardly came up. The parsnips came up the 1st of September and some did well. Carrots did the best of all. Our garden was the best private garden here. It is the first year of cultivation.

There is one thing that troubles us greatly here, and that is a small maggot that destroys the roots of turnips and ruta-bagas. If you can give me any advice how to get rid of them I will be very thankful to you.

I would like to plant some gooseberry and currant bushes. I have a few bushes now, but would like to plant some more. Will you let me know what varieties you think will do the best? I am also thankful for the report which you sent me. Some one sent me a few seeds not long ago, but they are not the right kind. I would like to ask you for some potatoes that you think will do well in Alaska.

Some of my carrots measure over 1½ inches across the top and are about 5 inches long.

B. H. Hefele, Skagway.—I will try to give you an account of the experiences I had the past season (1903) with the different varieties of seeds you sent me, and some seeds which I got from Bohemia.

The frost did not come out of the ground before the first part of May. I could only plant the vegetables all out by May 15, and then the frost was not out more than 12 inches.

I raised a lot of different plants in a hotbed, and planted the same out in the open air about the latter part of May. They were red beets, onions, cauliflower, cabbage, some virsing (a Bohemian vegetable, which heads like cabbage, but has the taste of kale), and some celery. I seeded lettuce of three different kinds in the open ground and had splendid results. My wife and I are very fond of lettuce, and we had it almost every day from the middle of June until September, just cutting above the root, and we had a new crop in two weeks. The red beets did very well, and from July until now we have been well supplied; in addition, have about 40 plants weighing in average about 2 and 3 pounds, all clean, and not in the least woody. Broad Windsor beans did fine, and I had quite a time to stop them from growing, but they never matured. I had worse luck with a row of Bayo (?) beans. The slightest cold wind turns the leaves black. Carrots, turnips, parsnips, and ruta-bagas did fine, but radishes were terribly wormy, so we could not use them at all. The cabbages and cauliflower were bothered with maggots, which ate the roots off about 1 inch below the surface. I used air-slaked lime with good success, and my neighbors after me. Celery was splendid, and there was none finer anywhere.

I had my ground all well manured with horse manure, which was not rotted enough, and we were all troubled on this account with a splendid crop of weeds, and I had all I could do to keep them out of the beds. I have had the ground in cultivation for four years and have always had plenty of manure, and last summer a half barrel of air-slaked lime.

I have only the evenings for my own use, so it is pretty hard to do any gardening for profit, but, in spite of being very short on time, I raised enough for our own use and some of our neighbors—in fact, more than my wife and I could consume—from a place about 25 by 50 feet.

I am keeping also a nice lot of chickens, and I made from an average of 20 chickens in 1902 a very nice profit, getting about 3,000 eggs during the season, besides the young chickens and fowls which I killed and sold. I figured out to have a clear profit of $104, the feed being mostly scraps from the household.

We also had a nice lot of flowers—pansies, mignonette, asters, bachelor buttons, marigolds, nasturtiums, geraniums, pinks, and carnations—all from seed in open ground except the first two varieties, which we started in the house.

I hope that these few items will contribute to the progress of vegetable farming in Alaska.

H. D. Clark, Skagway.—Your letter of October 7, 1904, was nearly two weeks in reaching me. I hope this report will reach you in time for your report, since you desire it. I have very little of good to report for Skagway in its vegetables and flowers this year. Potatoes, as a rule, were about one-fourth of a crop. Cabbage was practically a failure. A great many of the growing plants died

after setting out, either from worms or cold weather. A great many of those that lived have failed to head. From a 2½-acre cabbage patch we got less than 2 tons of cabbage. Beets are very poor, and parsnips below the average of other years. Carrots are a good crop, as a rule; from one patch of 18 square rods we harvested 2,200 pounds. Celery is also a good crop.

The season has been very dry and cold. The flower gardens have had a hard time. Dahlias, asters, and other flowers which have grown and blossomed luxuriantly other years have scarcely blossomed at all this year. We hope for different weather next season.

We find it almost impossible to raise either turnips or radishes on account of worms. Have you found any means of doctoring them successfully? We tried a soap and crude carbolic-acid emulsion with no satisfactory results.

I have bought Mr. Nicolai's interest in the Skagway ranch, and am putting up a 100-foot forcing house and intend to stay by the gardening business for a few years at least.

Rev. William L. Carle, Hoonah.—My garden this year (1903) was the best of any year so far. The following did nicely: Ruta-bagas, beets, turnips, lettuce, seed onions, radishes, cabbages, peas, rhubarb, and carrots. Beans did not do so well, as the ground was so dry that they were slow in coming up, but we had several messes. We also had an abundance of flowers—sweet alyssum, candytuft, poppies, and nasturtiums. I planted more seeds, but the ground was so dry that they did not germinate. The past summer was the driest ever known here. But I covered my garden heavily in the spring with seaweed and dug it under as best I could with a spade; result, the best garden in spite of the dry weather. My largest cabbages weighed 6 pounds, and ruta-bagas 2 pounds each. Some of the natives had ruta-bagas as big as three of mine.

I made a few experiments. I found that rhubarb grew three times faster simply by having a box with top and bottom removed laid around it. I began with a few plants, or rather, my wife did, while I laughed at her for her trouble, but I soon was converted to the plan and covered the whole number. I also found that to take onions and cut off for use all but the center and then to plant the latter, gave nice tops very quickly. I planted potatoes in the house and when the plants had made stalks 6 inches high I set them out in the garden. They made nice potatoes. I planted some potato parings, but the ground was so dry they did not sprout for some time, hence did not do very well. But I judge that parings are as good seed as pieces of potato.

I tried to ripen peas for seed, but am not sure if I succeeded, but I am inclined to think that they will grow. I had a few potatoes which grew from seed left in the ground of last year's crop. They did better than those planted. Would like to know from others if they plant Alaska-grown potatoes, or import seed each year. I believe some one should develop an Alaska strain of potato.

I planted my first garden May 6, and had lettuce and radishes June 30. May 25 I picked the first rhubarb. I planted radishes again July 14, which grew quickly, and we had great numbers to give away. We also gave away a large amount of lettuce, and almost every sailor that came into our harbor carried away a bouquet of flowers. Ruta-bagas, turnips, and cabbages, etc., stayed in the ground until October 24. They had been covered with 8 inches of snow in the meantime, but without damage.

Mrs. J. Gavigan, Valdez.—Following is my experience for 1904 with the seed which you so kindly sent:

Nothing grows better than kale, either Improved Siberian or Tall Curled Scotch. Grows rank as often as cut; winters without protection; supplies first early greens in spring and seeds second summer. I have never seen a

worm in it. Rhubarb also does well. My Champion ruta-bagas, planted in May, were in September 5 and 6 inches through. Early Jersey Wakefield cabbage and Early Paris cauliflower, started in the house, headed up pretty well, especially cabbage. Beets and Scarlet Horn carrots reached medium size. White turnips and all radishes are subject to a small maggot. I prefer small olive radishes, which grow quickly; if let remain in the ground they get wormy. I think everyone agrees that the Round Yellow turnip is far better than the White or Purple-Top, as it keeps better, is rarely wormy, is not peppery or watery, but crisp and sweet, like an apple, to eat raw. Our White turnips grow readily with but little care and reach a great size, but they are poor. Improved White Plume celery grew 15 inches high the second summer. The tall peas planted in rich soil ran all to vine and the few pods failed to fill before frost.

Of flowers, I find the pansies do the best for this rainy climate—bloom the second summer. Shirley poppies, fall sown, failed to come up; but May sown did well. Saponaria and Collinsia did well, but Xeranthemum and Gaillardia failed to grow. Sweet peas I have grown for two summers, but they are almost worthless, blooming, if at all, only a few days before frost. Our season is so short here that most annual flowers are not worth the trouble. I think perennials are better.

A. Lawson, Sunrise.—Looking over the weather reports you will see that the weather during 1904 has been cold and unfavorable for agricultural pursuits. I have just dug my potatoes and find that where I should have had over 4 tons, according to the yield of the three or four previous years, I got only about 400 pounds salable tubers, and, perhaps, as much more of small ones fit only for stock feed, scarcely worth gathering.

The greater part of my cabbage and cauliflower plants were destroyed by rabbits in June, and what I was able to save have grown slower and smaller than in former years. All my peas were a total failure, none maturing sufficiently for use. Turnips, lettuce, and radishes abundant and of good quality. Beets, carrots, parsnips, and onions rather small but otherwise tolerably good.

The winter wheat I planted last fall from seed you sent grew very nicely and headed out, but was beaten down by the heavy rain that fell August 11 and soon began to mold and rot, and so I had to clear it off the ground. The rye grew very well and was harvested September 24. I am now drying it and intend to use it for seed next year.

I presume that the weather has been unfavorable in other parts of Alaska, because the natives informed me that they never experienced such a cold and disagreeable summer before.

Dan Dougherty, Uyak Bay.—I am sorry to say that my garden has been a total failure this season (1904), as we had no summer. I planted 240 pounds of potatoes and will not get back the seed. Not even a radish.

Capt. J. Ducan, Mine Harbor, Herendeen Bay.—In a previous letter I wrote you that I was not expecting a good result of my gardening experiments, but to-day, alas, I regret to say that it was nearly a failure. Was it the gardener's or the climate's fault? It may be from both, but I dare to say that the former tried his best among the numerous difficulties he encountered, when, on the other side, the climatic conditions, jointly with poor soil, offered a serious obstacle to success.

Circumstances were bad. I had first to clear some brushy, rocky ground, which was a light sandy loam; the mold part of it was only 4 inches thick and when tilled the soil was of poor quality. Fertilizers should have been added,

but I had just enough to make a cold bed. I started the work as early as the end of April, when snow was yet covering many places around.

A cold bed of planks was placed against the kitchen wall, facing west exposure, and was filled with 1 foot of manure, covered with 8 inches of dirt. I had muslin sashes made to protect the bed at night; this proved to be a sufficient protection against late frosts. In that bed I sowed a variety of vegetables, which, except cabbage and kale, grew very poorly.

During the first week of May I sowed in the garden (divided into beds) all kinds of seeds, which took from fifteen days to one month to sprout. The trouble started with ground squirrels, which, ignoring my anger, were digging and eating the precious little sprouts. Savage war was declared on them, and with guns and traps I did exterminate hundreds of them.

However, part of the young plants were saved, and every day I was trying to ascertain an increase in their size, but this was in vain, for they nearly all reached 1 to 3 inches and died, excepting radishes and turnips, the latter growing as large as oranges.

Three times I transplanted cabbage and kale from the cold bed in the open but every time squirrels were feasting upon them. The cabbages that I saved grew in cold bed, but did not form heads. Kale also raised in cold bed grew vigorously.

Of flowers, mignonette, pansies, cornflower, and ten weeks stock were in bloom before killing frost. The others, like the vegetables, showed their leaves and died.

Now, about the most interesting branch of agriculture—wheat, barley, oats, and potatoes—I will make a special mention. Wheat with difficulty showed itself with poorly formed heads, and did not mature. Barley, though having good size, did not have a chance to mature, and was frozen before formation of the kernel. Oats were in better shape than the rest, reaching 3 feet high, with a vigorous growth. Kernels were formed and needed only a few sunny days to mature, but frost came instead, and everything was lost. On June 12 I planted some potatoes with manure underneath, and when frost appeared I harvested quite a lot of small tubers, the largest being the size of a chicken egg.

As a conclusion, and considering all phases of my first experiment, I am induced to believe that under better circumstances, and having a three or four years' well-fertilized soil, the chances to obtain some products from the soil should be greatly augmented, but I do not think that under such conditions a farmer would make a sufficient living out of the soil to decide to live permanently in this desolate part of Alaska.

Having a little part of the seeds left I may try again next spring, and in that case I will have the pleasure to tell you the result of my second experiment.

M. A. Davis, principal public school, Unalaska.—The garden seeds you so kindly sent me last spring, regardless of unfavorable conditions, did well during 1903 with few exceptions. The season was not all that could be desired, and then we were not prepared to plant them as soon as they should have been planted, owing to ill health and a change of residence at planting time. However, the lettuce, kale, cress, turnips, radishes, spinach, rhubarb, asparagus, and parsley did very well. Next season we can probably do better, as we have fenced in a small garden, and have put in a generous quantity of barnyard manure in heaps upon it for next spring.

Much of the flower seeds sent me was given to the natives, who take great pride in flowers. Many of the homes in the village have flowers growing and blooming from old tin cans, etc., in the windows. Near the schoolhouse is a native lady who has a fine pot of nasturtiums blooming in her front window.

Few of these natives have any relish for vegetables, except turnips and radishes, but most of them love flowers.

Rev. J. H. Schoechert, Quinhagak, Kuskokwim Bay.—Your favor of March 1, referring to the seeds sent, came to hand too late for use this year, 1904. Nevertheless, we have a blooming garden, a surprise to whites and natives alike, here on the coast of bleak Bering Sea.

We sowed our seeds and planted the potatoes from May 10 to 30 in the garden, while the hothouse was planted much earlier, so that by the middle of May radishes, lettuce, and cress were available for table use.

You refer to sharing seeds with the natives. This has always been done, the natives can get all the seeds needed, and the use of tools, etc., from the mission at any time.

As I found out by past years' experience, when inquiring of said inhabitants "Why don't you make gardens?" their common plea was, "We have nothing to make a fence to keep the dogs out." Consequently on our return from the States we brought sufficient wire to make two gardens. In part of one the natives can use all the ground they want. At least eight have small patches of ground with turnips, radish, ruta-bagas, etc. As they were a little slow about getting started, the mission garden was far ahead of theirs. On seeing how ours was cared for, watered in June, which was dry, and by giving them various pointers, they began to try to help theirs along. It was a pleasure to see men, women, and children carry water to water them—to watch them daily. Later on we had plenty of rain and now things are thriving.

It surely is one of the best means to help these people to procure a living by tilling the soil, and to prevent their becoming paupers, looking for rations from the Government when the game of the country is killed off. It no doubt will be slow work to see extensive gardens by them, yet when we remember how long it took the Indians in the States to take to farming we have every reason to take courage. Yes, I venture to say the Eskimos will pick it up more readily, being of a thrifty nature.

J. Hinz, Ogavik, Kuskokwim River.—Many thanks for the seeds you kindly sent me this year, 1904. I received them at the end of July at Bethel. Next year we will use the seeds here at Ogavik and report the results to you.

During the two years I have been in Alaska I lived at Bethel. The gardens there are pretty good. Last year we had excellent potatoes, turnips, cabbage, cauliflower, and many other vegetables. The potatoes were far better than those we received from San Francisco. (Pl. XII, fig. 1, show vegetables from gardens at Bethel.)

They have also been quite successful in gardening here at Ogavik. It seems the soil is very rich. This year the garden does not stand so very good, but the vegetables are better than we could expect.

As no missionary was living here last year the garden was not planted. This year I came up from Bethel on the 1st of June. With the help of some natives I prepared the ground, but it could not be done sufficiently. On June 3 we planted some potatoes, turnips, carrots, cabbage, onions, radish, lettuce, and other vegetables. After that I left Ogavik, and the garden was without care, for the natives, too, left the place, going to their fishing places. On August 3 I returned, and when I saw the garden I could scarcely see any vegetables, for grass and all kinds of weeds covered them. After having been cleaned, potatoes, turnips, and carrots recovered and grew nicely, but when the potatoes were flowering the frost killed them, August 26. They are still in the ground, also turnips, carrots, and onions, which have done pretty well. Radishes were already too big and old when we arrived here. The cabbage—Stone Mason—did not head. At Bethel we had Early Jersey Wakefield, which did very well.

FIG. 1.—GARDEN VEGETABLES GROWN AT BETHEL, KUSKOKWIM RIVER.

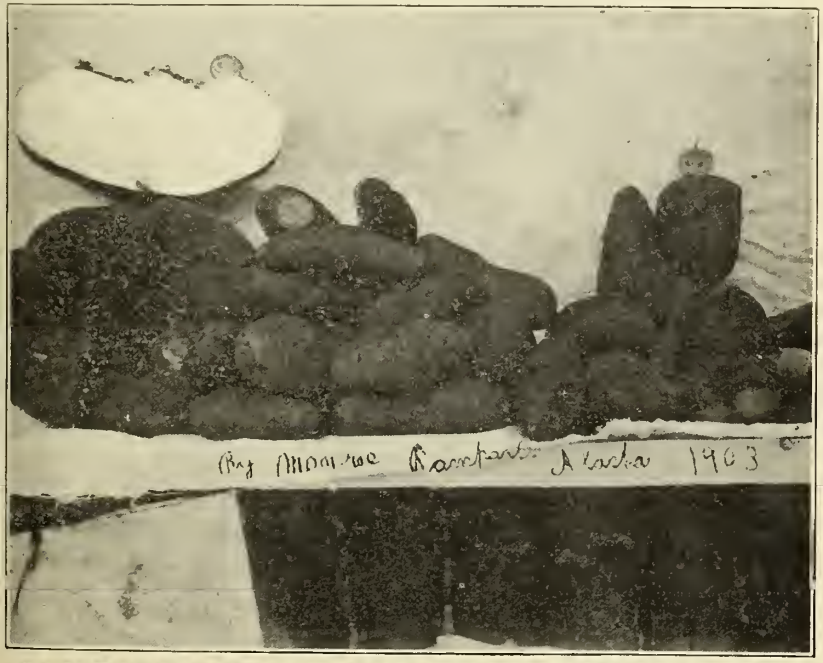

FIG. 2.—TURNIPS, POTATOES, CARROTS, AND CUCUMBERS FROM J. F. KARSHNER'S FARM, BAKER CREEK, TANANA.

John W. Dobbins, Nome City.—Many thanks to you for the garden seeds, which I received February 4, 1904. In reply to your request, I shall now endeavor as briefly as possible to give you a detailed account of my experiments in Nome, Alaska, since the year 1900, in growing vegetables, flowers, and grasses.

I arrived in Nome on July 28, 1900, and I have remained continuously ever since. I secured a town lot 50 by 150 feet. I built a cabin and spaded up the ground thoroughly. By chance, or by hustling, I found a lady who had one package of turnip seed, one package of beet seed, and part of a package of radish and lettuce seed mixed. I secured and planted these seeds on my lot. They grew wonderfully rapid and produced an abundant crop. It was a surprise to everybody to see them grow in Alaska soil in this northern latitude. They were the first garden seeds planted in Nome.

I also bought and planted 80 hills of potatoes. The young potatoes developed in size from marbles to that of a turkey's egg. I also planted 50 onion sets, which grew almost beyond description. The result was so satisfactory that I sent to San Francisco, Cal., for a variety of garden seeds, flower seeds, and grass seed for the spring of 1901. Most all the varieties, such as radishes, lettuce, peas in three varieties, beets, onions, cabbage, spinach, kale, parsley, cauliflower, carrots, parsnips, celery, etc., made a rapid and enormous growth. I used and gave away to the amount of about $75 worth of vegetables and flowers to visitors who called to see the Alaska garden, as they called it. The plants from California seed will not or did not reproduce and mature seed.

To fully determine if any seeds would mature in this climate I sent to New York and Detroit, Mich., for seeds for 1902. The result was far better than from the California seed, but only peas, spinach, French mustard, and radish seed matured.

All experiments thus far were in the open air. Beginning as soon as the ground could be worked in the spring, I prepared the ground in many ways. In some cases I used stable manure and native tundra; in other cases, sand, manure, and tundra; in some cases, wood ashes and black sand; in some cases, slaked lime and native tundra, and in some cases an intermixture of all; but in each case the result was good. I used pure spring water from the Nome City waterworks, through iron pipes.

Early York cabbage made some heads of good size, firm and crisp; price in the Nome market, 25 cents per pound, and ready sale. I used and gave away to visitors fully one-half of the experimental crops to encourage an interest in gardening and sold $155 worth off a lot 50 by 150 feet for the year 1902. I have bought another 50 by 150 feet adjoining the first one, and built a hothouse for the forcing of plants—not in the old-fashioned way, but by electricity—for the year 1903–4.

I have been corresponding with many reliable seed growers in the States—with some in Washington, D. C., with yourself, and with others elsewhere—and have obtained many reliable pointers, information, and varieties of domestic and foreign seeds and grasses. I have procured several varieties of flower and grass seed from Norway and Sweden, which have grown well this year (1903). I also planted red clover, white clover, timothy, redtop, bluegrass, orchard grass, lawn grass, and millet seed in many kinds of soil, every one of which grew rapidly, and the result was entirely satisfactory, especially red clover, timothy, and Norway grass, which will average from 2 to 3 feet in height and yield, I think, from 1½ tons to 3 tons per acre with ordinary conditions. Hay (timothy) shipped to Nome is now selling for $50 per ton.

I have a water pipe laid through the center of my experiment ground connected with the city waterworks, which supplies water perpetually during the spring, summer, and fall months. It cost me $100 for the pipe and labor of con-

structing it and $10 per month for the use of the water continuously. I have a 65-foot hose and two faucets so arranged as to spray on water rapidly or at leisure.

The experiments and results I have thus far shown have created in the minds of many of the Nome residents an interest in beautifying their homes by planting vegetable and flower gardens. A number of small gardens were planted, with successful results in many instances.

The vegetable seeds I planted for the year 1903 are as follows:

Radish—Long Scarlet, Small Round Scarlet, Half Long Purple, Black Spanish, and Snow White. Long Scarlet and Long White were the choice; they sold for 50 cents per dozen. Lettuce—Grand Rapids, California Cream, and Hauson; Grand Rapids the choice; 25 cents per dozen. I sold 400 dozen lettuce plants at 25 cents per dozen and 100 dozen radish at 50 cents from 6 beds of 8 by 8 feet. Cauliflower—One small package of seed produced about 150 strong, healthy plants. They made an enormous growth, but only 2 heads formed, transplanted late on account of a cold, late spring. Sold for chicken feed. Cabbage—Early Dwarf York was propagated by electricity in greenhouse and transplanted late, made a rapid growth, but only a few heads proved of superior quality. Cabbage in Nome market sells for 25 cents per pound. Peas—American Wonder (dwarf). This pea does not deserve its name. The rows were a solid mass of pods and the pea as sweet as sugar. Alaska Prolific was a good producer, but not as good as the American Wonder. The Giant pea, 6 feet high; a good producer, but requires poles or frames. Sold for chicken feed. Asparagus—About 50 roots from this year's planting. Celery seed failed to grow. Parsley grows well, price 25 and 50 cents for a small bunch. Spinach grows well, ready sale at a good price. Carrots were of slow growth, but produces well at end of the season. Parsnips—The same as carrots. Onions (Red) do well from seed and sets better. Mustard grows prolific; ready sale in early spring. Beets (Long and Round) do well; will be a success. Sweet corn grows slow; will not be a success. Cucumber was a failure this summer; did not blossom. Tomatoes were also a failure. String beans were a failure; rotted in the ground. Turnips were excellent in growth and taste; a success. Potatoes were of average size and good flavor; will be a success. Ruta-bagas were a wonder in size and taste; excellent.

Flowers of almost all varieties flourish and bloom in this latitude. I had only three sunflower seed, which I planted, and each produced a plant of good size; both stem and flower, but no seed matured. Pansies did well, many plants in bloom; a success. Stock and candytuft were also a success. Larkspur did well, many plants in blossom; a success. Crimson flax (grandiflorum)—Plants in blossom; a success. Lobelias (in baskets)—Plants in blossom; a success. Nasturtium—Splendid; plants in blossom; a success. China aster seed failed. Bachelors button—Splendid; a success. Marigold (Norway)—Not a success this year. Arctic mint (native)—Sweet odor, small blossoms; excellent for borders.

Strawberries—I imported 250 plants, but they were damaged in shipping and failed to grow.

Rhubarb—12 roots; 9 lost in shipping.

Not one berry nor fruit tree has been introduced in Nome so far. Only three rose bushes in Nome so far to my knowledge. All things being favorable, I wish to experiment this year (1904) in berry plants, such as blackberry, raspberry, strawberry, and gooseberry, and hop vine, and also a few fruit trees and currant bushes, rose bushes, and ornamental shrubs.

Wild blueberries grow abundantly here, and thousands of varieties of beautiful wild flowers.

Grasses of the following varieties do well: Red clover—excellent; from 18 inches to 3 feet high; strong root. White clover—very good, from 6 to 18 inches high, and strong root. Timothy—very good; from 2 to 3 feet high; thick and fine. Bluegrass—excellent; ground a solid mat; growth about 12 inches. Orchard grass—did well; thick and fine, spreading. Redtop did well; thick and fine; growth, 2 feet. Lawn grass a success; grows rapidly; thick and fine. Norway grass—starts and grows slow; coarse, kind unknown. Wild rye—will grow well; result from seed in baled hay.

These experiments have been on a limited scale, but sufficient to prove that vegetables, flowers, and grasses will be a success in many cases and profitable beyond a doubt.

E. B. O'Connor, Council City.—I tried to raise a little garden truck in 1904, with but little success, and as I did very well outside can not fathom the reason for my failure here. I hear that your seeds do well here, and therefore ask you to send me some. My potatoes have done exceedingly well in rich land well mixed with manure. Lettuce does well, but radishes and onions are very poor. I have good bottom land soil mixed with manure, and I put it on a little sloping ground up from the river bottom. Seeds should reach us this fall, so as to plant in the early spring.

C. W. Thornton, Solomon.—In regard to seeds sent me for trial in 1904, I planted beets, turnips, carrots, cauliflower, onions, radishes, sweet peas, and nasturtiums. I distributed to others lettuce, radishes, turnips, beets, carrots, and sweet peas. All of these seeds sprouted well, and in every instance in which they were given a little care they did well, with the exception of the onions. I think perhaps that our season is too short to produce good onions from seed. The most satisfactory results were obtained from radishes and lettuce.

J. V. O'Hare, S. J., Holy Cross Mission, Koserefsky.—The crops in general are not so good as usual, owing to the backward season. I might also accuse the season of forwardness, for the last few nights have been cold, with a light frost during one night. Temperature, August 25–26, minimum 33°; August 26–27, minimum 36°. I fear that the oats grown from seed and matured here last season—1903—are injured by the cold.

We have now 8 head of cattle, which are furnishing an abundance of rich milk. Another addition, and a welcome one, is the chicken ranch. We have over 20, large and small. Fresh eggs add much to the cook's possibilities. However, both cattle and chickens have suffered from the savage canines in spite of many precautions.

One horse was unable to do all the work last winter, so a gentle bull was broken in and is doing so much better than the horse that he was put into the plow last spring, while his weaker rival was relegated to a small harrow.

More land is being cleared of trees and stumps and broken, so that very soon that glorious meadow you photographed will be under cultivation. The grass that you so admired for its rank luxuriance gradually declined until it was found better to begin breaking it for cultivation. Clover and timothy are doing fairly well.

Sugar beets—an experiment—poor; probably on account of the cold and dry summer, that is, the first half of the season. Squashes have blossomed and formed fruit, but will not have time to amount to anything. Tomatoes blossomed, but they did not form fruit. Cabbage suffering from worms at the roots, otherwise fair. Mangels doing quite well.

Flowers of many kinds in profusion, and are much admired as well as desired by the passengers on the river boats. One can hardly imagine himself in

Alaska when he sees the noble rose the product of the patient and skillful care of the sisters.

Our boys and girls are now out on a four-day berry picking. This is a yearly event, very enjoyable as well as profitable, as they bring home some 6 or 8 barrels of berries, mostly blueberries. Raspberries, currants, and several other kinds grow wild in abundance, free to all comers.

Down in the Yukon delta I saw this summer the most forlorn little garden in the world. After nine weeks' growth the radishes, though very good, were just becoming large enough to eat, while the lettuce had perfect heads about the size of a silver dollar. That locality is evidently not intended for a garden of Eden. On arriving there on June 1 I found the river banks still piled up with the ice from the Yukon, with great snow drifts on the bushes, and no sign of leaves on the trees. I should not say trees, for there is nothing deserving the name in the whole place.

John W. Chapman, Anvik.—The season of 1904 has been a long one, but cold and backward. Successful sowings of radishes, lettuce, rhubarb, peas, corn salad, and parsnips were made April 28. The peas were the Prolific Early Market, and yielded a fine crop, maturing August 15. American Wonder peas sowed May 31 set very full, but should have been planted two weeks earlier.

Wakefield and Dwarf York cabbages were planted in a cold frame April 28 and protected by glass. They were set outside May 25. The Wakefield made solid heads, while the York has just commenced to head. Snowball and Paris cauliflower were given the same conditions, and the Snowball succeeded, while the Paris failed. Rhubarb, started in the same way, has made fine, healthy plants. Radishes were ready for the table on June 6. The French Breakfast gave the best results.

A few potatoes were sent us by a neighbor from the Koserefsky stock. We ate the potatoes and planted the parings, giving them a start in the cold frame, on April 28. They were removed to new ground, turned up last spring on May 25. Fifty hills yielded 45 pounds. The size and quality were good. On old ground in Isaac Fisher's garden the same stock yielded a pound and a half, average of a row of 13 hills, dug to-day.

Most of the planting in all the gardens in this neighborhood was done between May 10 and 15. An ivory white potato from our supplies received from Seattle yielded a pound to the hill on new ground under favorable conditions. Sowings of Purple Strap Leaf turnips on June 23 are successful.

The sowings so far discussed were made in warm gulches on the north side of the low hills at Anvik. The ground was new, mostly a dark loam. Nearly everything succeeded, but beets, sowed May 24, were a failure. In a garden made by Mr. W. C. Chase, they succeeded admirably. Mr. Chase's garden is on lower ground upon which slops had been thrown out for several years. It has a southern exposure. His carrots and Early Round parsnips were also successful, though small.

Successful potato gardens were made by Messrs. L. F. Cooper and Max Simel, traders; by Mr. Chase, and by Isaac Fisher and Peter Redlands, the last two of whom are natives. Isaac Fisher's garden (Pl. XIII, fig. 1) is quite a large one, about 75 by 75 feet, and is one of the best in the place. He has excellent potatoes, White Strap Leaf turnips, Champion ruta-bagas, Wakefield cabbages, and a few Snowball cauliflowers. Some twenty or more natives made gardens, but most were poorly cultivated and weedy. Their success is enough to encourage them to try again, and the number of successful ones will doubtless increase yearly.

I take pleasure in inclosing a photograph made by Mr. A. L. Kurtz (Pl. XIII, fig. 2).

FIG. 1.—GARDEN OF ISAAC FISHER (NATIVE), ANVIK, 1904.

FIG. 2.—VEGETABLES GROWN AT ANVIK MISSION, 1904.

We have had great pleasure from the flowers grown from the seed which you sent. Nemophilas and candytuft in July were followed by corn flowers, pansies, mignonette, and clarkias, and stocks. The stocks were sowed May 24 and began to bloom about two weeks ago. Sweet William and Chinese pinks planted on the same date have grown well, but have not yet made buds.

Something over half a ton of potatoes were raised in Anvik this year and harvested September 17. Several ruta-bagas weighing 2 to 3 pounds were harvested, but, in general, they were sowed too late for a good result. They should have been sown as early as the ground could be worked.

A. H. Monroe, Rampart.—I visited J. F. Karshner's Hot Springs farm again last January and took a photograph of some of the vegetables he still had which were raised in 1903. He requests me to make a report for him and thank you for the seeds that you sent him. Of course his farm is not an average representative farm for this northern climate, for he has 200 acres of black soil that never freezes because of the heat of the earth.

The thermometer registered 62° below zero while I was there, and the wind was blowing some, yet I found turnips and ruta-bagas in the ground where they grew and were not frozen.

Mr. Karshner has settled down for life on this farm and will endeavor to produce vegetables for the miners of the surrounding country. Last year he raised more than 100 bushels of potatoes, which he sold readily at 10 cents per pound. His turnips did well, some reaching an enormous size, weighing 16 pounds and measuring 39½ inches in circumference. Ruta-bagas as large as 14 pounds, which he disposed of for 5 cents per pound. Fifty-two cabbage plants produced 52 good heads, the largest weighing 12 pounds, which he sold at 15 cents per pound. Beets, some weighing 4 pounds and sold at 15 cents per pound. Head lettuce as large as 2½ pounds.

Here is what Mr. Karshner says:

"Began clearing land October, 1902. Began planting peas, beets, lettuce, and turnips April 20, 1903. Came out of the ground May 1. Potatoes were up May 20, cucumbers, pumpkins, and beans May 26. Sowed oats June 3, and they were ripe September 5. Radishes and lettuce were large enough to eat in June. Carrots, turnips, beets, peas were large enough to cook July 4. Potatoes large enough to use August 15.

"Carrots and parsnips attained a diameter of 4 inches. Yellow wax beans planted May 26 picked August 12. Squash planted May 26 ripe September 20. Largest cucumber 9 inches long. The vines yielded well. The beans yielded well; some pods 4 inches long and well filled. Peas did excellently. Kale excellent; 2 feet high. Buckwheat planted July 4 began to fill September 15, but the rabbits ate it. Mustard did well and ripened 3 quarts of good seed. Onion seed ripened also. Radish and lettuce seed also ripened nicely."

He will have 3½ acres in cultivation this year (1904), and will plant wheat and oats of different varieties, and also clover and timothy seed if he had them. He especially wishes to try winter wheat, which he desires you to send him a sample of; also a few celery seed.

Mr. Karshner followed farming before he came to Alaska and likes the work, is well satisfied here and has no desire to return to the States. His farm will give better returns than most of the gold mines for the amount of labor put onto it, in this camp.

The season was exceptionally dry, so that some gardens dried up. The rabbits destroyed nearly everything I planted last year. Wheat did not mature here, but the grasses did well, and timothy headed out a little. The rhubarb got so late a start that if it lives will do well this year.

I believe that some varieties of crab apples would grow on Mr. Karshner's place, because service berries do well and grow abundantly over there.

J. F. Karshner, Magic Hot Springs, Baker Creek Station.—I inclose report of agricultural work for the season of 1904. Owing to your request to have my report early I can not give you full report, but will send in later a few lines.

The weather has been rather cold and backward the whole season. At present and for the last two weeks it has been raining, somewhat after the fashion of the weather along the coast of Washington, which made my cabbage burst, especially the early kinds. This being the second crop on some of the ground, I find it doing much better than last year. You will see by the dates of planting that the cabbages vary considerably, some being early, others quite late. I have no team as yet, and grubbing is rather slow, but I hope to do better next year.

However, everything is doing well. The growth is quite rank. I got a few small packages of Romanow wheat and Manshury barley, and also buckwheat, all of which I seeded. At present barley is ripe. It stands about 4 feet high, and I never saw better barley. The wheat is about the same height, but later; it is in the dough at this writing, and looking fine. The buckwheat is about 2 feet high, and filling nicely, and I doubt not but that it will mature all right. I will send you samples later.

I received the winter wheat and other seeds which you sent me in due season. I will sow the wheat the first of September, and next spring I will try the oats, etc.

On April 18 I seeded cabbage, celery, cauliflower, and broccoli on the slope ot the hill which is warmed by the heat from the springs below. All came up well. May 20 I transplanted Early York and Jersey Wakefield cabbage for early marketing, and July 20 had heads that weighed 4 pounds. The late cabbage was transplanted June 6, and is at this writing heading finely. The early cauliflower is now on the market; the heads are large and fine, some weighing 4 pounds. The heads of the early cabbage are bursting. Late cabbage is not bursting much, and the celery is looking fine.

On April 20 I seeded turnips, lettuce, radishes, and rhubarb. The turnips (Early Milan) were large enough to cook June 2. Lettuce and radishes mature very quickly here, and I sow a little of both every few weeks for table use. The rhubarb is growing nicely and I think it will do well here.

On April 28 I noticed some volunteer potatoes coming up, and they had new potatoes fit for use by July 4. May 7 I planted potatoes in the field, and they have done well, in fact far above the average. I had some that weighed 2 pounds each. The crop planted at that date has already been marketed. Potatoes planted May 30 are about out of bloom at this writing and doing well. June 14 I planted more potatoes, and they are in full bloom at this date.

May 10 I planted Broad Windsor and Early Red Valentine beans. Both are doing well and I think that they will mature. On the same date I planted cucumbers and Golden Wax beans. The cucumbers are looking well and full of small fruit, and the Wax beans are loaded with pods and I think will be large enough for use, as were some I planted last year.

May 25 I seeded Half Long carrots, Early Egyptian beets, Hollow Crown parsnips, and Champion ruta-bagas. All of these are doing finely.

May 10 I planted peas, the variety called "Earliest and Best," and I had peas for July 4. I planted a succession of peas, and three crops are ripe. I shall have plenty of seed for next year.

June 18 I planted turnips, kohl-rabi, ruta-bagas, and summer squash, and all are doing finely. The seed of the squash was late in coming, hence the late planting, but they are filling out very well at this date, and I shall have at least a few large enough to cook.

May 27 I sowed some tomatoes. This is too late for good tomatoes, but they have made a heavy growth and are in full bloom at present.

I measured some of my second sowing of turnips, and some of them measured 29 inches in circumference, with plenty of time to grow yet.

I expect some large cabbage from my Late Flat Dutch and Drumhead varieties, but will report on these later.

It is somewhat as you say about the ranch I have being better than a placer claim. I did not appreciate it until this year, but all the crops have done better than last year, in spite of the fact that this has been a cold summer; but cold or hot, dry or wet, I see but very little difference; only a longer and heavier growth when too wet. (Pl. XII, fig. 2.) I have cabbage leaves that measure 26 and 30 inches.

The potatoes I planted are Burbank, but by looking at them since they are grown you would not know what variety to call them. They resemble some I had in Washington, which I sent to La Crosse, Wis., for and called the Governor Rusk. I wish I had the same kind to try here. I would also like to try the Early Ohio or the Michigan.

About those wireworms: Ashes did not kill them; they were there just the same, but the ashes gave me a smoother potato, and the worms did not bother them as much. I put a shovelful on the hill when the potatoes were about a foot high, and then hilled them up, covering the ashes. I shall try freezing them this season, and I believe that will be a specific. Chickens would get away with many of them. I notice the robins in early spring are always following me when I grub the ground, always picking and digging for them, and these welcome friends are always here in the early spring, and they remind one of the States and of civilization.

I shall have quite a lot of seeds from radishes, turnips, and ruta-bagas, which will mature this season. They are about all ripe now.

Some one suggested in your report that a man should be hired to travel about and teach the natives to farm. I believe that would be a good plan. I have quite frequent visits from natives, and all seem to take an interest in what I am doing. They wonder at the growth and ask the names of different vegetables. They like to eat them, too, and I have given them quite a few. I tell them also to come in the spring and get some seeds to plant themselves, so if you could send me an extra amount of different kinds, but especially of turnips, I shall divide with them. Potatoes seem to be their favorite vegetable. One of them asked me if I was going to raise oranges. I will try peanuts next spring if I can get a few that are fresh.

I had a small package of corn sent me; received too late for planting this year. One must plant early, so that the hot weather in June can get its work in on corn. I may not mature corn, but I am most certain I can raise roasting ears.

If you can send me a few cherries and other fruit trees, I will try them in my warm ground.

John A. Clinton, Rampart.—Inclosed find a few heads of Manshury barley, the seed of which you sent me two years ago, and one head of oats. When received, the paper of oats was eaten by mice, so I could not see the name. The barley I sowed May 26, 1903. It came up fine with a good stand and grew fast; headed out by July 10. I sowed it in a garden patch about 30 by 30 feet of good land. It had been tilled for three years. I built a good fence around it. I felt proud of my barley patch, when about that time the mice living in the adjoining wild land got a taste for the tender, sweet stems, and went for it like a crew of loggers slashing into a choice patch of timber. I felt sore about it. But for the fact of our keeping some 20-odd wolfish, ever-hungry native dogs, I would have gone in for some wholesale poisoning of mice. The few plants the mice

spared me are all ripe now. The oats are turning yellow. We have had no frost yet (September 8, 1903).

This summer has been an average one. Spring came about ten days to two weeks later than last year. June dry and hot. July rather wet and cool.

All of the hardy vegetables did well. Of lettuce, the Early Curly and Prize Head did the best. The Boston Market went to seed before it made good heads. The cauliflower is very fine; Dwarf Erfurt, largest 8 inches in diameter. Beets, Egyptian did the best. Cabbage, Early Wakefield; some weigh 5 pounds and still growing. Ruta-bagas, White Fleshed; most advanced; do better when transplanted; make a cleaner root than when seeded in place. Turnips do about as well as a native weed; I consider them a sure crop any year, especially the Purple-Top Strap Leaf; the White Milan is more delicate, but does not keep well in winter. Peas did well. Early Alaska comes in about two weeks ahead of Abundance. Parsley and carrots did not do well, but may grow yet. Cress has done very well. I had never sowed any before. It was a surprise. I sowed it in a shady place; kept it well watered. We cut it about every ten days. It came in before the lettuce. It is all right. Parsley and onions did not come up well.

The flowers all came up well. As I write this I see in front of the window, unhurt by frost, sweet peas, mignonette, nasturtiums, poppies, petunias, marigolds, and some others. They are good to look upon.

The weather is fine for this time of the year, and the garden truck is still growing. I would like to try some of the hulless barley. The grass seed you sent I sowed as soon as the snow went off in some favored spots where the fire had destroyed the moss. Have not had time to look up results.

Rev. G. S. Clevenger, Copper Center.—Yours of November received, and I thank you for the grain and seeds which you think you can furnish us. I keep constantly at the Indians about planting gardens. I think we can make a start next year with them in gardening.

The weather up to this time (December 7, 1903) has been fine. One can work outside every day. We have been getting our hay down from the lake, about 5 miles from Copper Center. We bale it and then haul it down on sleds. We will have about 200 bales of, say, 75 pounds each. We were told that the swamp grass was no good. My cow is in very fine condition on it with very little feed besides. I do not feed her quite 2 quarts of meal a day. She is really fat.

Copper Center is not nearly so dreary as Skagway or Valdez. We have so much sunshine that the days do not seem so short. We think it is as fine a climate as we have ever lived in, thus far much preferable to that of South Dakota. Our greatest difficulty is isolation and mails so far apart.

C. M. Frazier, Eagle.—Your letter of January 29 duly received. I am mining in the upper Tanana. I spent last season in that country.

I was raised on a farm in Iowa, and will always take an interest in agriculture. I read your report for 1902 with great interest, and I will note some facts concerning the Tanana Valley.

Within 8 miles of the Tanana Crossing 25 tons of redtop hay was cut on less than 3 acres in a very few days last July (1903), and hundreds of acres just as good were untouched. Dense forests of spruce, birch, and cottonwood of good size extend to the headwaters. The soil is varied. Where the cottonwood grows it is gravel after you get down a little, muck where the grass is plentiful, and vegetable mold where the spruce and birch stand. The valley is from 15 to 50 miles wide and 200 miles long above the crossing; not more than 2 feet of snow in winter, and very little wind. From personal observation and from men and Indians living there I obtained these facts. The trail, Eagle to Valdez, follows the cottonwood ridges.

Rev. John B. Driggs, Point Hope.—My experiments in raising vegetables at Point Hope have not proved a success. I am on my way south to spend a winter in the States, and on my return north next year (1905) hope to continue my experiments. I will say that the past four or five years have been very unfavorable.

Frank E. Howard, U. S. Commissioner, Coldfoot.—I distributed the seed, and the consequences are that during 1904 there are a number of flourishing gardens in Coldfoot and on the creeks. My own garden is growing nicely, notwithstanding the cold nights during June. I have cabbage just beginning to head, radishes for the table, turnips for greens, peas over a foot high, and will have lettuce in a day or two. I have potatoes over a foot high with blossoms just started. Beets are 2 inches high, kale 10 inches; parsnips and carrots are growing slowly, but rather doubtful.

I will continue the weather report as long as I remain in the office, and will send you a full report of the crops in the fall.

I request that you send me another lot of seeds as early as it would be convenient for you to mail them, for if they do not get here before the close of navigation this fall they will not be in time for planting next spring. The principal seeds should be turnips, ruta-bagas, lettuce, radishes, cabbage, and peas, and also some flowers.

Several Indian families here have expressed their willingness to plant patches of turnips and ruta-bagas next spring if they can get the seeds and receive a few instructions in gardening. I will undertake the latter if you will supply them with the former. I have given them several messes of greens, and I believe with a little encouragement they would enter into gardening with enthusiasm. The Indians here are quite different from those on the coast of Alaska. They are strictly sober, virtuous, and industrious.

SOIL TEMPERATURES.

I submit herewith daily records of the soil temperatures at the three stations, Sitka, Kenai, and Copper Center. The readings are from two thermometers, one of which has the bulb buried in the soil 6 inches deep, and the other has it buried 2 feet deep. At Sitka and Copper Center we have in addition a radiation thermometer, placed near the soil thermometers, and suspended 6 inches above the surface of the ground. This is for the purpose of ascertaining the lowest temperature during each 24 hours near the surface of the ground. The radiation thermometer is practically only a minimum thermometer, which records the lowest figure to which the temperature falls. We find that it frequently records temperatures from 2° to 4° lower than the regular Weather Bureau minimum thermometer, which is placed in a shelter box about 4 feet from the ground. Being unprotected the radiation thermometer is more sensitive to slight variations in temperature. Sometimes it indicates a drop below the frost line, when the sheltered instruments show a considerably higher temperature. These slight drops of short duration seldom kill any but the tenderest plants, but they nevertheless have their influence in retarding growth, and to a certain extent on the radiation from the soil.

It is worth while for those interested in the subject to study the soil

temperatures as here recorded. It will be noticed that the 6-inch thermometer shows considerable fluctuation from day to day, while the 24-inch thermometer shows scarcely any daily fluctuation. The fluctuations in the 6-inch thermometer are due to the alternations of rain and sunshine. But the one important fact is that unless the 6-inch thermometer maintains an average above 52° from the middle of June to the middle of August, grain crops can not prosper. If this average is maintained hardy plants, like oats and barley, will develop, but their maturing is still dependent on the length of time frosts hold off.

Soil temperatures.

SITKA EXPERIMENT STATION.

Day.	6-inch thermometer.	24-inch thermometer.	Radiation thermometer.	Day.	6-inch thermometer.	24-inch thermometer.	Radiation thermometer.	Day.	6-inch thermometer.	24-inch thermometer.	Radiation thermometer.
1904.	°F.	°F.	°F.	1904.	°F.	°F.	°F.	1904.	°F.	°F.	°F.
May 1	------	------	------	June 25	48.5	45.0	46.0	Aug. 19	53.0	51.0	48.0
May 2	39.0	35.0	------	June 26	48.0	45.5	43.0	Aug. 20	52.0	50.5	46.0
May 3	37.5	35.0	35.0	June 27	48.5	45.5	45.0	Aug. 21	52.0	50.5	47.0
May 4	35.0	36.0	35.5	June 28	48.5	45.5	48.0	Aug. 22	53.0	50.5	47.0
May 5	35.5	36.5	33.0	June 29	48.0	45.5	42.0	Aug. 23	53.0	50.5	47.0
May 6	36.0	36.0	37.0	June 30	48.0	45.5	38.0	Aug. 24	53.5	50.5	48.0
May 7	40.5	36.0	44.0	July 1	48.0	46.0	41.0	Aug. 25	53.5	50.5	47.0
May 8	40.5	36.0	41.0	July 2	48.0	46.0	43.0	Aug. 26	53.0	50.5	42.0
May 9	40.0	37.0	33.0	July 3	48.0	46.0	38.0	Aug. 27	52.0	50.5	35.0
May 10	40.5	37.0	27.0	July 4	48.0	46.0	42.0	Aug. 28	52.0	50.5	38.0
May 11	40.5	37.0	30.0	July 5	48.0	46.5	38.0	Aug. 29	52.5	50.5	44.0
May 12	41.5	37.5	38.0	July 6	48.0	46.5	36.0	Aug. 30	53.5	50.5	45.0
May 13	42.5	37.5	40.0	July 7	48.0	46.5	33.0	Aug. 31	54.0	50.5	44.0
May 14	43.0	38.0	38.0	July 8	49.0	46.5	45.0	Sept. 1	54.0	50.5	41.0
May 15	43.0	38.5	36.0	July 9	49.0	46.5	43.0	Sept. 2	53.0	50.5	39.0
May 16	42.5	38.5	36.0	July 10	49.0	46.5	40.0	Sept. 3	53.0	51.0	48.0
May 17	43.5	39.0	37.0	July 11	49.0	46.5	39.0	Sept. 4	54.0	51.0	50.0
May 18	43.0	39.5	35.0	July 12	49.5	46.5	41.0	Sept. 5	54.0	51.0	48.0
May 19	42.5	39.5	41.0	July 13	49.5	47.0	35.0	Sept. 6	53.0	51.0	47.0
May 20	42.5	39.5	39.0	July 14	49.5	47.0	45.0	Sept. 7	51.0	51.0	43.0
May 21	42.5	40.0	35.0	July 15	49.5	47.0	43.0	Sept. 8	50.0	51.0	38.0
May 22	43.0	40.5	35.0	July 16	50.0	47.0	43.0	Sept. 9	51.0	51.0	44.0
May 23	43.0	40.5	36.0	July 17	50.0	47.0	39.0	Sept. 10	50.5	50.5	46.0
May 24	43.0	40.5	30.0	July 18	51.5	47.0	47.0	Sept. 11	51.5	50.5	44.0
May 25	43.5	40.5	33.0	July 19	51.5	47.5	45.0	Sept. 12	51.5	50.5	46.0
May 26	43.5	41.0	40.0	July 20	51.5	47.5	45.0	Sept. 13	52.0	50.5	42.0
May 27	44.0	41.0	37.0	July 21	51.0	47.5	39.0	Sept. 14	51.5	50.5	------
May 28	45.0	41.0	38.0	July 22	51.5	47.5	45.0	Sept. 15	51.5	50.5	46.0
May 29	45.0	41.5	38.0	July 23	51.0	48.0	43.0	Sept. 16	51.5	50.5	44.0
May 30	45.0	41.5	40.0	July 24	51.0	48.0	44.0	Sept. 17	50.5	50.5	45.0
May 31	46.0	42.0	40.0	July 25	51.0	48.0	47.0	Sept. 18	49.5	50.5	35.0
June 1	47.5	42.0	43.0	July 26	51.5	48.0	46.0	Sept. 19	48.5	50.0	36.0
June 2	47.5	42.0	43.0	July 27	53.0	48.5	51.0	Sept. 20	45.5	50.0	38.0
June 3	47.5	42.5	35.0	July 28	53.0	48.5	48.0	Sept. 21	46.5	49.5	40.0
June 4	47.5	43.0	44.0	July 29	52.5	49.0	------	Sept. 22	46.0	49.5	31.0
June 5	47.5	43.0	38.0	July 30	52.5	49.0	48.0	Sept. 23	46.0	49.0	30.0
June 6	46.0	43.5	30.0	July 31	53.0	49.5	48.0	Sept. 24	47.0	49.0	31.0
June 7	46.5	43.5	34.0	Aug. 1	52.0	49.5	46.0	Sept. 25	49.5	48.5	47.0
June 8	47.0	43.5	40.0	Aug. 2	51.5	49.5	46.0	Sept. 26	49.5	48.5	45.0
June 9	48.0	43.5	41.0	Aug. 3	51.0	49.5	45.0	Sept. 27	49.5	48.5	45.0
June 10	48.0	44.0	43.0	Aug. 4	52.5	49.5	45.5	Sept. 28	49.0	48.5	44.0
June 11	48.0	44.0	41.0	Aug. 5	52.0	49.5	37.5	Sept. 29	------	------	------
June 12	48.0	44.0	35.0	Aug. 6	52.5	49.5	38.0	Sept. 30	------	------	------
June 13	47.0	44.0	41.0	Aug. 7	54.0	49.5	41.0	Oct. 4	44.5	48.5	29.0
June 14	47.0	44.5	42.0	Aug. 8	54.5	49.5	45.0	Oct. 5	44.0	48.0	29.0
June 15	47.0	44.5	42.0	Aug. 9	54.0	50.0	49.0	Oct. 6	43.0	48.0	27.0
June 16	47.0	44.5	40.0	Aug. 10	53.5	50.0	36.0	Oct. 7	42.5	47.5	26.0
June 17	46.5	44.5	40.0	Aug. 11	54.0	50.0	47.0	Oct. 8	42.0	47.0	26.0
June 18	46.5	44.5	41.0	Aug. 12	54.0	50.0	47.0	Oct. 9	44.0	47.0	39.0
June 19	47.0	44.5	42.0	Aug. 13	54.0	51.0	50.0	Oct. 10	46.0	46.5	49.0
June 20	47.0	44.5	42.0	Aug. 14	54.0	51.0	49.0	Oct. 11	46.0	46.5	42.0
June 21	47.5	45.0	32.0	Aug. 15	53.0	51.0	36.0	Oct. 12	46.5	46.5	40.0
June 22	47.5	45.0	37.0	Aug. 16	53.0	51.0	42.0	Oct. 13	46.5	46.5	41.0
June 23	48.5	45.0	43.0	Aug. 17	54.0	50.5	41.0	Oct. 14	46.5	46.5	41.0
June 24	48.5	45.0	45.0	Aug. 18	53.0	51.0	46.0	Oct. 15	45.5	46.5	39.0

Soil temperatures—Continued.

KENAI EXPERIMENT STATION.

Day.	6-inch thermometer.	24-inch thermometer.	Day.	6-inch thermometer.	24-inch thermometer.	Day.	6-inch thermometer.	24-inch thermometer.
1904.	° F.	° F.	1904.	° F.	° F.	1904.	° F.	° F.
May 10	36.0	.....	June 27	48.0	40.5	Aug. 14	52.0	46.5
May 11	38.0	.....	June 28	51.0	40.5	Aug. 15	52.0	46.5
May 12	36.5	.....	June 29	52.5	40.5	Aug. 16	53.0	46.5
May 13	38.5	.....	June 30	52.0	41.0	Aug. 17	51.5	46.5
May 14	40.0	.....	July 1	49.5	41.0	Aug. 18	52.0	46.5
May 15	38.5	.....	July 2	48.5	41.5	Aug. 19	52.0	47.0
May 16	38.5	.....	July 3	51.0	41.5	Aug. 20	52.0	47.0
May 17	39.0	.....	July 4	52.5	41.0	Aug. 21	49.5	46.5
May 18	39.0	.....	July 5	52.5	41.5	Aug. 22	50.5	46.5
May 19	38.0	.....	July 6	51.0	41.5	Aug. 23	50.5	46.5
May 20	41.5	.....	July 7	49.0	41.5	Aug. 24	52.0	46.5
May 21	41.5	.....	July 8	50.5	41.5	Aug. 25	51.5	46.6
May 22	42.0	.....	July 9	50.0	41.6	Aug. 26	49.5	46.5
May 23	41.0	.....	July 10	51.5	42.0	Aug. 27	49.0	46.5
May 24	41.5	.....	July 11	53.5	42.0	Aug. 28	50.0	46.0
May 25	41.5	.....	July 12	54.0	42.0	Aug. 29	52.5	46.0
May 26	44.0	.....	July 13	52.0	42.5	Aug. 30	53.5	46.0
May 27	45.0	.....	July 14	54.0	42.5	Aug. 31	51.5	46.5
May 28	45.0	.....	July 15	55.0	43.0	Sept. 1	54.0	46.5
May 29	42.5	.....	July 16	56.0	43.0	Sept. 2	54.0	46.5
May 30	42.5	.....	July 17	55.5	43.5	Sept. 3	52.5	46.5
May 31	42.5	.....	July 18	55.5	43.5	Sept. 4	53.0	46.5
June 1	45.0	33.5	July 19	56 5	44.0	Sept. 5	52.5	46.5
June 2	45.5	34.0	July 20	55.0	44.0	Sept. 6	48.5	46.5
June 3	46.0	34.5	July 21	56.5	44.5	Sept. 7	48.0	46.5
June 4	47.0	35.0	July 22	53.5	44.5	Sept. 8	48.0	46.5
June 5	47.5	35.5	July 23	53.5	45.0	Sept. 9	47.5	45.5
June 6	48.0	36.0	July 24	51.5	45.0	Sept. 10	48.0	45.0
June 7	46.0	36.5	July 25	52.5	45.0	Sept. 11	45.5	45.0
June 8	48.0	36.5	July 26	53.5	44.5	Sept. 12	48.0	45.0
June 9	49.5	36.5	July 27	52.0	44.5	Sept. 13	46.0	45.0
June 10	50.5	37.0	July 28	52.0	44.5	Sept. 14	46.0	45.0
June 11	50.5	37.5	July 29	52.0	44.5	Sept. 15	47.0	45.0
June 12	50.5	38.0	July 30	51.0	44.5	Sept. 16	48.0	45.0
June 13	51.5	38.5	July 31	53.0	45.0	Sept. 17	45.0	44.5
June 14	52.5	39.0	Aug. 1	51.5	45.0	Sept. 18	43.5	44.5
June 15	52.5	39.0	Aug. 2	51.0	45.0	Sept. 19	43.5	44.0
June 16	49.0	39.5	Aug. 3	52.0	45.0	Sept. 20	39.5	43.5
June 17	50.0	40.0	Aug. 4	52.0	45.0	Sept. 21	39.5	42.5
June 18	48.5	40.0	Aug. 5	52.5	45.0	Sept. 22	42.0	42.0
June 19	48.0	40.0	Aug. 6	53.5	45.5	Sept. 23	44.5	41.5
June 20	52.5	40.0	Aug. 7	56.0	45.5	Sept. 24	46.0	42.0
June 21	49.0	40.5	Aug. 8	57.0	46.0	Sept. 25	45.5	42.5
June 22	49.0	40.5	Aug. 9	57.0	46.0	Sept. 26	45.5	42.5
June 23	48.0	50.5	Aug. 10	57.5	46.5	Sept. 27	45.0	43.0
June 24	49.0	40.5	Aug. 11	52.5	46.5	Sept. 28	45.0	43.0
June 25	49.0	40.5	Aug. 12	52.0	47.0	Sept. 29	42.0	43.0
June 26	47.0	40.5	Aug. 13	51.0	47.0	Sept. 30	41.0	42.5

Soil temperatures—Continued.

COPPER CENTER EXPERIMENT STATION.

Day.	6-inch thermometer.	24-inch thermometer.	Radiation thermometer.	Day.	6-inch thermometer.	24-inch thermometer.	Radiation thermometer.	Day.	6-inch thermometer.	24-inch thermometer.	Radiation thermometer.
1904.	° F.	° F.	° F.	1904.	° F.	° F.	° F.	1904.	° F.	° F.	° F.
May 6	35.0	31.0	19.0	June 25	50.5	42.0	37.0	Aug. 14	48.0	45.5	19.0
May 7	35.0	31.0	28.0	June 26	50.0	42.0	36.0	Aug. 15	48.0	45.0	17.0
May 8	35.0	31.0	20.0	Juue 27	48.5	42.0	34.0	Aug. 16	48.5	44.5	16.0
May 9	36.0	31.0	15.0	June 28	49.5	42.0	39.0	Aug. 17	48.5	44.0	12.0
May 10	37.0	31.0	22.0	June 29	52.0	42.0	37.0	Aug. 18	47.5	44.0	17.0
May 11	38.0	31.0	24.0	June 30	47.5	42.5	33.0	Aug. 19	48.0	44.0	34.0
May 12	38.0	31.0	22.0	July 1	49.0	42.5	22.0	Aug. 20	48.0	44.0	33.0
May 13	40.0	31.0	28.0	July 2	50.0	42.5	30.0	Aug. 21	48.5	44.0	30.0
May 14	38.0	31.5	25.0	July 3	48.0	42.5	34.0	Aug. 22	50.0	44.0	35.0
May 15	38.0	31.5	21.0	July 4	47.0	42.5	25.0	Aug. 23	50.0	44.0	33.0
May 16	38.0	31.5	30.0	July 5	47.5	42.0	32.0	Aug. 24	50.0	44.0	32.0
May 17	38.0	31.5	18.0	July 6	49.0	42.0	26.0	Aug. 25	48.0	44.0	25.0
May 18	38.5	32.0	24.0	July 7	50.0	42.0	32.0	Aug. 26	44.0	43.5	12.0
May 19	39.0	32.0	27.0	July 8	49.0	42.5	33.0	Aug. 27	45.0	43.5	27.0
May 20	39.0	32.0	23.0	July 9	49.0	43.5	33.0	Aug. 28	44.0	43.5	27.0
May 21	40.0	32.0	31.0	July 10	49.0	42.5	32.0	Aug. 29	44.5	43.5	31.0
May 22	40.0	32.0	23.0	July 11	52.0	42.5	42.0	Aug. 30	46.0	42.0	32.0
May 23	42.0	32.0	19.0	July 12	50.0	42.5	29.0	Aug. 31	46.5	42.0	31.0
May 24	42.5	32.0	32.0	July 13	51.0	43.0	37.0	Sept. 1	46.5	42.0	21.0
May 25	42.5	32.0	19.0	July 14	52.0	43.0	35.0	Sept. 2	45.0	42.0	11.0
May 26	42.5	32.0	24.0	July 15	52.5	43.5	25.0	Sept. 3	45.0	41.5	13.0
May 27	42.5	32.0	23.0	July 16	52.0	43.5	24.0	Sept. 4	45.0	41.5	15.0
May 28	42.5	32.5	24.0	July 17	54.0	44.5	36.0	Sept. 5	43.0	41.5	10.0
May 29	42.5	33.0	25.0	July 18	52.5	45.0	23.0	Sept. 6	40.0	41.0	11.0
May 30	42.5	33.0	33.0	July 19	55.5	45.0	38.0	Sept. 7	39.0	40.5	4.0
May 31	43.5	33.5	25.0	July 20	49.0	45.0	23.0	Sept. 8	38.0	40.0	2.0
June 1	47.5	33.5	28.0	July 21	52.5	45.0	35.0	Sept. 9	38.0	40.0	14.0
June 2	46.0	34.5	24.0	July 22	49.5	44.5	28.0	Sept. 10	40.0	40.0	26.0
June 3	48.5	35.0	30.0	July 23	50.0	44.5	34.0	Sept. 11	40.0	39.0	23.0
June 4	49.0	35.5	34.0	July 24	48.0	44.5	34.0	Sept. 12	41.0	38.5	28.0
June 5	49.0	35.0	32.0	July 25	50.0	44.0	22.0	Sept. 13	42.5	38.5	28.0
Juue 6	48.0	36.0	32.0	July 26	51.0	44.0	21.0	Sept. 14	42.5	39.0	25.0
June 7	47.0	36.5	31.0	July 27	53.0	44.5	22.0	Sept. 15	42.5	39.0	26.0
June 8	46.5	36.5	33.0	July 28	51.0	44.5	32.0	Sept. 16	38.0	39.0	10.0
June 9	47.0	37.5	26.0	July 29	50.0	44.5	32.0	Sept. 17	38.0	39.0	13.0
June 10	48.0	37.5	36.0	July 30	50.0	44.5	31.0	Sept. 18	38.0	39.0	11.0
June 11	49.0	38.0	37.0	July 31	48.5	44.5	30.0	Sept. 19	34.5	37.5	−8.0
June 12	47.5	39.0	29.0	Aug. 1	50.0	44.5	35.0	Sept. 20	33.0	37.0	−8.0
June 13	48.0	39.0	26.0	Aug. 2	50.5	44.0	36.0	Sept. 21	33.5	36.5	5.0
June 14	50.0	39.5	34.0	Aug. 3	49.0	44.0	34.0	Sept. 22	32.0	35.0	7.0
June 15	49.0	40.0	30.0	Aug. 4	47.5	44.0	18.0	Sept. 23	37.0	37.0	19.0
Juue 16	48.0	40.0	35.0	Aug. 5	47.5	44.0	17.0	Sept. 24	37.0	37.0	19.0
June 17	45.5	40.5	35.0	Aug. 6	50.0	43.5	28.0	Sept. 25	38.0	36.5	31.0
June 18	46.5	40.5	28.0	Aug. 7	51.0	43.5	25.0	Sept. 26	39.0	37.0	25.0
June 19	47.0	40.5	29.0	Aug. 8	54.0	44.0	22.0	Sept. 27	40.5	37.5	38.0
June 20	50.0	40.5	36.0	Aug. 9	55.0	44.5	19.0	Sept. 28	37.5	38.0	15.0
June 21	49.0	41.0	33.0	Aug. 10	55.5	45.0	25.0	Sept. 29	37.5	38.0	20.0
June 22	49.0	41.0	30.0	Aug. 11	55.5	45.5	41.0	Sept. 30	35.5	38.0	3.0
June 23	51.0	41.5	34.0	Aug. 12	51.5	45.5	36.0				
June 24	50.5	42.0	33.0	Aug. 13	50.5	45.5	34.0				

METEOROLOGICAL REPORTS.

As in former years, the writer has had general supervision of the voluntary weather observers of the Weather Bureau in Alaska, and submits herewith more or less complete reports from 28 stations. Their records are made daily, but since these daily records would occupy too much space in this report they have been condensed so as to give the result for each month. They show the maximum and minimum temperatures which occurred during the month; but the most important column is the one showing the daily mean, it being the correct average temperature for the entire month.

Space does not permit comment on these reports now, but at an early date a bulletin should be published on the climate of Alaska, as it may be presented from the accumulated reports during the past six years.

Meteorological observations.

SITKA. C. C. Georgeson, observer.

Month.	Temperature.			Total precipitation.	Weather conditions (number of days).			
	Maximum.	Minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1903.	° *F.*	° *F.*	° *F.*	*Inches.*				
October	59	30	45.36	14.82	3	7	21	26
November	54	16	36.35	6.5	.....	13	17	15
December	49	25	40.11	14.97	.....	9	22	22
1904.								
January	44	5	30.22	9.76	5	4	22	14
February	43	10	25.5	23.01	18	6	5	1
March	51	7	32.17	3.04	15	10	6	6
April	56	59	40.73	3.39	.....	20	10	19
May	57	33	44.4	3.80	.....	10	21	21
June	56	32	47.06	3.22	4	5	21	22
July	62	34	55.8	5.95	.....	12	19	26
August	70	40	52.9	4.14	6	14	11	.....
September	71	36	50.51	13.27	5	9	16	23

KENAI. P. H. Ross, observer.

1903.								
September	62	20	45.5	2.72	12	8	10	12
October	59	−2	31.14	.77	6	8	17	8
November	34	−27	17.56	.78	9	2	19	6
December	40	−10	20.03	.18	7	3	21	6
1904.								
January	35	−34	8.7	.46	14	4	13	7
February	31	−27	5.18	.29	23	2	4	2
March	42	.....	.....	.02	24	5	2	1
April	55	.....	.....	.34	5	12	13	2
May	61	24	44.14	.....	22	5	4	.....
June	65	29	48.3	.87	14	6	10	9
July	65	27	49.55	2.44	13	6	12	13
August	73	25	50.7	3.5	8	9	14	14
September	75	11	44.64	4.01	19	2	9	10

COPPER CENTER. J. W. Neal, observer.

1903.								
October	52	−11	24.75	1.71	6	9	16	7
November	35	−37	−3.64	.2	17	11	2	8
December	39	−19	6.3	.8	2	9	19	.....
1904.								
January	42	−59	−12.3	.31	21	3	5	2
February	25	−47	−10.7	.22	17	3	8	1
March	47	−42	3.6	.....	18	.....	13	.....
April	58	8	34	.24	10	10	10	4
May	75	21	44.59	.82	.....	11	20	12
June	76	32	52.03	1.11	.....	13	17	13
July	82	32	52.67	1.8	5	11	14	13
August	87	24	52.22	2.09	6	6	18	13
September	67	6	40.5	.73	16	5	9	7

Meteorological observations—Continued.

LORING. Fred Patching, observer.

Month.	Temperature.			Total precipitation.	Weather conditions (number of days).			
	Maximum.	Minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1903.	° *F.*	° *F.*	° *F.*	*Inches.*				
November	54	8	34.33	16.7	6	.....	24	19
December	53	22	39	21.5	2	.....	29	25
1904.								
January	46	− 6	20.25	16	1	1	29	23
February	40	− 6	17	3.8	11	5	13	.....
March	54	−10	26.82	1.5	19	.....	12	7
April	62	26	45.96	7.75	10	.....	20	16
May	69	27	44	16	3	5	23	18
June	66	35	49	10.6	5	6	19	19

McHENRY INLET. John C. Callbreath, observer.

1904.								
July[a]	63	44	53	5.1	.....	1	10	11
August	75	41	54.85	1.84	10	8	11	9
September	67	35	50.4	.22	4	6	20	24

PETERSBURG. J. A. Goding, observer.

1904.								
July	70	35	52.3	9.2	2	7	22	21
August	76	34	52.8	1.93	16	6	9	8
September	64	30	44.15	15.33	6	5	19	7

JUNEAU. S. J. Sharick, observer.

1903.								
August	75	42	31.7	5.45	9	.....	3	.....
September	65	37	50.2	6.94	6	.....	1	.....
1904.								
April	60	20	42.8	7.83	17	1	12	.....
May	65	30	48.05	6.7	20	3	8	.....
June	68	31	49.3	10.66	15	.....	15	.....
July	69	42	57.1	7.15	11	.....	17	3
August	74	36	54.2	4.04	24	.....	7	.....
September	68	32	49.3	9.68	15	.....	15	1

SKAGWAY. H. D. Clark, observer.

1903.								
October	55	22	40.5	9.99	7	3	21	17
November	44	10	28.07	1.6	7	11	12	7
December	47	17	33.69	3.35	4	6	21	8
1904.								
January	43	−11	21.0	1.44	7	11	13	10
February	32	− 3	10.7	.....	25	5	4	.....
March	52	2	22.79	.33	21	7	3	3
April	58	27	41.25	2.31	5	13	12	4
May	68	27	47.5	.84	10	17	4	6
June	70	33	51.7	.97	3	15	12	6
July	77	39	56.4	1.07	3	16	12	6
August	80	31	56.9	.18	8	16	7	.....
September	67	32	47.4	2.8	7	12	11	6

[a] July for 11 days.

Meteorological observations—Continued.

KILLISNOO. Joseph Zuboff, observer.

Month.	Temperature.			Total precipitation.	Weather conditions (number of days).			
	Maximum.	Minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1903.	° F.	° F.	° F.	*Inches.*				
October	55	26	42.9	12.45	2	1	4	24
November	50	15	33.5	3.65	3	5	5	16
December	47	25	36	5	2	4	7	18
1904.								
January	47	3	27.9	4.3	5	4	2	20
February	38	7	19.2	1.25	19	4	1	5
March	46	13	27.6	1.2	17	3	5	6
April	54	30	40.7	1.35	1	11	19	13
May	59	28	45.4	1.75	2	11	9	9
June	63	35	49	3.35	.....	11	3	16
July	63	38	51.05	4.6	.....	8	3	20
August	70	41	53.5	2.3	11	10	5	5
September	65	32	47.7	7.7	3	4	3	20

ORCA. W. J. Shephard, observer.

1903.								
October	54	28	38.15	17.6	4	6	21	19
November	47	15	30.98	13.24	6	8	16	13
December	44	24	33.95	23.44	2	.....	4	18
1904.								
January	42	11	27.55	11.59	9	3	17	11
February	38	8	25.65	.....	19	8	2	.....
March	52	11	34	72	16	11	1	.....
April	58	30	38.85	13.55	4	16	.....	8
May[a]	65	31	43.88	4.7	3	5	7	4
June[b]	.....	.....	.....	.....	.....	.....	.....	.....
July[b]	.....	.....	.....	.....	.....	.....	.....	.....
August[b]	.....	.....	.....	.....	.....	.....	.....	.....
September	84	34	35.85	9.12	10	19	13	.....

FORT LISCUM. C. J. Bartlett, observer.

1903.								
October	50	16	33.65	6.62	15	.....	16	16
November	42	4	23.31	5.62	15	.....	15	17
December	43	12	28.09	9.61	5	.....	26	20
1904.								
January	42	− 7	22.58	6.8	15	.....	15	16
February	42	2	21.89	.5	21	.....	8	1
March	49	5	24.79	.1	25	.....	6	1
April	52	22	36.2	4.5	7	.....	23	20
May	58	30	43.86	.68	16	.....	15	14
June	61	36	48.24	2.15	6	.....	24	16
July	66	38	48.77	5.61	6	.....	25	20
August	75	34	11.67	12.75	5	.....	26	21
September	70	30	44.73	7.96	12	.....	18	13

SUNRISE. A. Lawson, observer.

1903.								
October	52	8	32.5	2.61	8	5	18	11
November	38	−15	17.2	3.37	9	3	18	12
December	48	4	25.3	3.7	8	8	15	12
1904.								
January	40	−21	11.5	1.69	13	3	15	10
February	31	−16	8.7	.13	25	2	2	3
March	42	− 11	16.4	.28	25	3	3	3
April	56	20	35.4	5.08	4	4	22	21
May	62	27	44	1.01	13	12	6	8
June	68	31	49	1.36	11	7	12	15
July	70	34	51.2	1.05	6	11	14	18
August	76	31	51.4	5.2	4	6	21	24
September	70	20	44.2	2.33	13	3	14	16

[a] 15 days in May. [b] Not reported.

Meteorological observations—Continued.

TYOONOK. Durell Finch, observer.

Month.	Temperature.			Total precipitation.	Weather conditions (number of days).			
	Maximum.	Minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1903.	° F.	° F.	° F.	*Inches.*				
September	68	28	49.2	2.76	17	2	11	10
October	53	13	34.6	1.15	11	1	19	6
November	39	−8	21.1	.64	12		18	4
December	41	3	27.9	.57	7		24	8
1904.								
January	35	−15	13.4	1.07	13	1	17	7
February	37	−11	14.1	3	26		3	1

WOOD ISLAND. Rev. Curtis P. Coe, observer.

1903.								
September	71	39	54.4	7.95	3	1	26	14
October	54	26	40.74	6.27	5	6	20	14
November	53	11	33.11	3.3				15
December	45	24	35.25	8.29	4		27	21
1904.								
January	52	8	28.41	2.63	7	4	20	14
February [a]								
March	47	14	28.45					
April	48	24	37.47	3.68	7	5	18	20
May	63	31	41.93	3.35			9	7
June	68	36	50.38	2.26				11
July	69	42	52.37	1.36	19		12	11
August	68	42	53	4.89	5		26	
September	65	40	50.3	.63	16	13	1	10

COAL HARBOR, UNGA ISLAND. Henry S. Tibbey, observer.

1903.								
October	55	22	37.5	2.52	7	9	15	13
November	41	18	30.7	2.54	8	6	16	21
December	46	19	31.9	4.75	7	4	20	21
1904.								
January	39	8	26.2	2	13	8	10	16
February	50	−1	22.7		17	6	6	
March	51	10	29	2	13	5	10	
April	45	29	31.25	9.35	7	8	15	
May	52	31	39.95	30.8	13	2	14	
June	61	35	45.9	1.21	9	4	17	9
July	70	39	50.3	4.22	6	4	21	20
August	60	41	49.5	4.17	2	6	23	21

MINE HARBOR, HERENDEEN BAY. Capt. J. Ducan, observer.

1903.								
September	58	31	48.3	5.1	1	1	28	27
October	55	18	36.7	3.97	3	2	26	24
November	40	15	28.7	2.6	2	1	27	20
December	43	13	30	5.92	3	1	27	14
1904.								
January	39	−2	23.3	3	6	2	23	11
February	41	−7	21.2	.49	8		21	4
March	44	4	23.6	.30	6	1	24	6
April	45	3	28.05	1.42		1	29	14
May	53	22	37	.81	4		27	14
June	58	31	43.5	1.30		3	26	7
July	65	37	47.7	3.79	1	3	27	21
August	79	40	51.5	4.25	4		27	24

[a] Not reported.

Meteorological observations—Continued.

NUSHAGAK. J. Kahlen, observer.

Month.	Temperature.			Total precipitation.	Weather conditions (number of days).			
	Maximum.	Minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1904.	° *F.*	° *F.*	° *F.*	*Inches.*				
July	79	39	18	2.47	9	6	16	13

CANDLE. R. S. Dimmick, observer.

1903.								
October[a]	37	−21	11.00		11	3	2	1
November	27	−27	.62		10	2	14	
December	31	−35	2.8		9		20	
1904.								
January	23	−46	− 7		7		23	
February	28	−44	−64		9		18	

KOTZEBUE. Dana Thomas, observer.

1904.								
January	22	−50	−13.45					
February	34	−32	− 5.25					
March	34	−18	5.69					
April	45	10	15.55					
May								
June	66	30	44					

POINT BARROW. H. R. Marsh, M. D., observer.

1903.								
November	13	−26	− 7.48		12		18	
December	24	−29	− 8.35		15		16	
1904.								
January	− 6	−40	−24.75		25		6	
February	−25	−38	−12.95		17	1	11	
March	33	−39	− 2.63		15	6	9	
April	30	−36	1.6		21		9	

FORT GIBBON. Frederick F. Simmons, observer.

1903.								
September	68	17	40.73	0.48	24	3	3	2
October	47	−23	12.57	.22	21	4	6	3
November	24	−40	− 6.48	.33	26	2	2	2
December	24	−30	− .64		15	7	9	
1904.								
January	−20	−53	−19.1	.08	19	7	5	2
February	18	−51	−16	.55	16	9	4	4
March	−45	−47	−30.64	.35	17	7	7	3
April	54	−12	25.7	.09	21	8	1	1
May	68	25	23.7	.22	25	4	2	2
June	85	39	62.76	.53	24	3	3	1
July	80	50	62.19	1.95	11	10	10	10
August[b]	75	57	59.55	3.8	16		14	11

FORT EGBERT. John B. Clayton, observer.

1903.								
August	81	20	53.34	2.97	13	3	15	12
September[c]								
October[c]								

[a] 19 days in October.
[b] 5 days in August.
[c] Not reported.

Meteorological observations—Continued.

TEIKHIL. Joseph H. Embleton, observer.

Month.	Temperature.			Total precipitation.	Weather conditions (number of days).			
	Maximum.	Minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1904.	° F.	° F.	° F.	Inches.				
March	46	−24	18.5	0.5	17	3	11	
April[a]	58	10	35.35	7.25	9	3	18	2
May		16		.4	12	1	18	
June		28		7.9	15	4	11	3
July		28		1.53	7	3	21	
August	100	25	51.5	2	12	3	16	
September	70	11	40.5	1.21	12	2	16	14

CHESTOCHENO. Ray M. Martin, observer.

1904.								
April[b]	60	25	42.00		7			
May[c]								
June[c]								
July	89	41	59.33		16	3	10	2
August	86	27	53.4	4.01	14	9	8	12
September	65	15	36.03	2.01	16	6	8	9

TANANA CROSSING. John A. Perry, observer.

1904.								
May	68	23	45.2	0.76	15	7	9	6
June[c]								
July	76	30	52.4	.78	15	10	6	4
August	79	23	48.45	.89	16	12	3	2
September	63	3	29.08	.96	14	11	5	3

KETCHEMSTOCK. Daniel B. McCarthy, observer.

1904.								
May	60	19	32.1	0.81	5	26		
June	70	27	48.2	.83	4	24	2	
July	76	27	51.7	2.23	3	23	4	

FORT YUKON. Leonidas J. H. Wooden, observer.

1903.								
September		18		1.7				
October[d]	40	−15	27.3	12.8				
November	12	−41	36.45	2.6				
December[e]	26	−36	32.03	3.8				
1904.								
January[f]	−2	−61		6.9				
February		−55		9.2				
March		−45		.8				
April[g]		−14		4.8				
May[h]	73	24	45.68	5				
June[i]	83	27	56.1	2.5				
July[j]	82	43	66.5	11.9				

COLDFOOT. Frank E. Howard, observer.

1904.								
February	20	−46	−18.56	3.5	17		12	11
March	41	−43	.80	2.5	13	8	10	15
April	56	−19	27	.9	9	7	14	5
May	76	25	44.1	.6	16	7	8	3
June	82	29	51.75	1.25	14	8	8	8
July	81	34	59	3	8		23	9

[a] Maximum for 26 days in April.
[b] 7 days in April.
[c] Not reported.
[d] October maximum for 21 days, minimum 25 days.
[e] December maximum for 28 days.
[f] January maximum for 10 days.
[g] April maximum for 7 days.
[h] May maximum for 23 days.
[i] June maximum for 24 days.
[j] July maximum for 30 days.